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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD

HEARING

In the Matter of:

ENTERGY NUCLEAR VERMONT

YANKEE, LLC

and

ENTERGY NUCLEAR OPERATIONS,

INC. (Vermont Yankee Nuclear

Power Station)

Docket No. 50-271-LR

ASLB No. 06-849-03-LR

Thursday, July 24, 2008

Windham County Superior Court

7 Court Street

Newfane, Vermont

BEFORE:

ALEX S. KARLIN, Chair, Administrative Judge

RICHARD E. WARDWELL, Administrative Judge

WILLIAM REED, Administrative Judge

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P R O C E E D I N G S

8:30 A.M.

JUDGE KARLIN: Good morning. I'm Alex Karlin. This is the fourth day of the Atomic Safety and Licensing Board evidentiary hearing in the matter of the application by Entergy for a license renewal for 20 years for its Vermont Yankee Nuclear Power Plant.

Today, we are proceeding with -- continuing on contention 4 that deals with flow-accelerated corrosion and we started yesterday afternoon and I thought we made some progress. And hopefully, we're going to try to cover everything we need today. It is possible we'll have a session tomorrow, but we think we can get it done today if the witnesses can hopefully answer crisply our questions. We'll try to ask direct questions and maybe we can get this done today.

So with that I would like to remind the witnesses that you're still under oath and if you'll remember that as we proceed. I'm sure you will.

Is there anything from my colleagues?

(No response.)

Is there anything from counsel?

MR. LEWIS: Yes, Judge Karlin, I have two

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1 preliminary items. First, the Board had requested
2 that Entergy provide transient cycle information, the
3 actual cycles.

4 JUDGE KARLIN: Yes.

5 MR. LEWIS: We have obtained that data and
6 can pass it out now. We've produced a table and
7 marked it and I propose to pass it out and then the
8 Board can decide how they'd like to proceed with that.

9 JUDGE KARLIN: Why don't you hand it out
10 and let the-- has the other counsel seen it?

11 MR. LEWIS: Not yet.

12 JUDGE KARLIN: Okay. Absent any
13 objection, I suppose we'll bring it into the record.
14 Everyone should get a chance to look at it first.

15 (Pause.)

16 MR. LEWIS: May I approach the bench and
17 provide it to all the Board.

18 JUDGE KARLIN: Yes, Mr. Lewis, sure.

19 (Pause.)

20 JUDGE KARLIN: It's one page, right?

21 MR. LEWIS: Yes, Judge Karlin, one page.
22 Just for the record of what I've handed out it's
23 called Vermont Yankee transient counting status, July
24 23, 2008. We've marked it as A2-39 for identification
25 in case that's how the Board wants to treat it.

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1 JUDGE KARLIN: All right, and what does
2 this reflect?

3 MR. LEWIS: This reflects in the left-hand
4 column, it's a three-column table. The left-hand
5 column is the description of the transients. The
6 middle column is the number of cycles that were
7 actually assumed in the confirmatory analyses that
8 were performed. And the right-hand column is the
9 actual number of cycles as tracked by the plant.

10 JUDGE KARLIN: All right. Any objections
11 to -- I think this is a valuable thing that we asked
12 for this information. Absent any objections, I think
13 we're going to admit it as Exhibit E2-39.

14 MS. TYLER: Judge Karlin, I don't have an
15 objection to the admission of this document, but I
16 would like to note that none of the underlying
17 documentation from which they determined these numbers
18 is in the record.

19 JUDGE KARLIN: I think that's a good note,
20 all right. So we'll admit it. Thank you for that
21 information, Ms. Tyler.

22 MR. LEWIS: The second preliminary item,
23 Judge Karlin, is -- and if you would object to the
24 witnesses for NEC using computers during their
25 questioning. We do have internet access in here and

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1 the witnesses' access to a computer does allow the
2 possibility of communications during the questioning
3 which I would submit is improper.

4 In addition, witnesses are entitled to
5 have documents to refresh their recollections and with
6 a computer there's a potential they're looking at more
7 than that. I'm not saying they are. It just would
8 compromise the integrity of their questions. It is
9 the general rule as reflected in Rule 612 of the Rules
10 of Evidence that any document or material that the
11 witness takes to the stand to use to refresh his
12 recollection during testimony is subject to
13 examination by the other parties and by the tribunal.
14 A witness who has a computer could avoid that and so
15 we think it's just -- not suggesting the witnesses are
16 going to do anything improper, but I think it
17 challenges the integrity of their testimony.

18 JUDGE KARLIN: Well, seems to me that
19 we're using computers to try to access the huge volume
20 of material we're trying to refer to. Perhaps that's
21 what's going on.

22 Ms. Tyler, do you have any --

23 MS. TYLER: I think both Dr. Hausler and
24 possibly I'll assume Mr. Witte have the exhibits only
25 on their computer and they didn't even bring hard

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1 copies. That's they they're using the computers. I'm
2 not in email communication with them and I think that
3 they can represent that they're not looking at
4 anything other than the materials and that should be
5 adequate.

6 JUDGE KARLIN: All right. Let me ask Dr.
7 Hausler. Are you doing any internet, email
8 communication?

9 DR. HAUSLER: It's my understanding,
10 Judge, that there is a password for the internet and
11 I do not have the password.

12 JUDGE KARLIN: Well --

13 DR. HAUSLER: Which means I'm not on the
14 internet.

15 JUDGE KARLIN: You're not emailing anyone
16 while this is going on?

17 DR. HAUSLER: I am not.

18 JUDGE WARDWELL: Do you have the
19 capability to turn off your card, your wireless card?

20 DR. HAUSLER: I have to check that, sir.
21 I don't have a wireless card, but I probably do have
22 --

23 JUDGE KARLIN: I think it's sufficient --

24 DR. HAUSLER: It's not turned on.

25 MR. LEWIS: Judge Karlin, I would accept

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1 the representation by the witnesses that they won't
2 use wireless communication during testimony and I
3 guess I would also accept if they would simply
4 represent if they do use their computer to access any
5 document other than the exhibit, they identify what it
6 is that they're looking at.

7 JUDGE KARLIN: All right, let me ask the
8 witnesses that way. Will you affirm and commit that
9 you're not using any wireless communication while your
10 testimony is going on?

11 MR. WITTE: Yes, I will. I've got a
12 button here that I can turn --

13 JUDGE KARLIN: I don't care how you do it,
14 just so long as you don't do it.

15 Dr. Hausler, I guess you're --

16 DR. HAUSLER: Absolutely. That's easy.
17 I will not.

18 JUDGE KARLIN: Fine, and that the only
19 documents that you're accessing are the exhibits in
20 this case?

21 MS. TYLER: Judge Karlin, Dr. Hopenfeld is
22 looking at notes that he has before him and it's
23 possible that Dr. Hausler and Mr. Witte also have
24 notes on their computer that they're referring to
25 which I think is appropriate.

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1 JUDGE KARLIN: I think we're going to let
2 it go. Everyone has got a huge pile of information in
3 front of them, documents, hard copies or whatever, and
4 I'm not going to try to figure out whether all of them
5 are exhibits or if they have anything in addition. So
6 thank you. I think we're going to let it proceed.

7 JUDGE WARDWELL: I think it be useful
8 though when you are reading from something that's
9 obviously one of our documents, if you let us know
10 what you're reading from. It's obvious --

11 DR. HAUSLER: Absolutely.

12 JUDGE WARDWELL: You know what they are,
13 but it's not so clear behind the screen.

14 JUDGE KARLIN: All right.

15 MR. LEWIS: We have no more preliminary
16 items.

17 JUDGE KARLIN: Thank you, Mr. Lewis.

18 MS. BATY: Your Honor, I have one
19 preliminary matter, clarification about Dr. Chang's
20 testimony. We have not yet offered that testimony as
21 an exhibit in this proceeding and I wanted to talk
22 with Marcia of how you would like for us to add that
23 as an exhibit in this proceeding.

24 JUDGE KARLIN: Yes, I think it should be
25 an exhibit to the proceeding rather than entered it as

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1 testimony.

2 MS. BATY: I will mark it as an exhibit,
3 as a staff exhibit and provide it to Ms. Carpentier.

4 JUDGE KARLIN: Okay.

5 MS. BATY: As appropriate --

6 JUDGE KARLIN: Please do. I think it
7 already had an exhibit number on it, did it not?

8 MS. BATY: Yes, it did.

9 JUDGE KARLIN: Can we use that one?

10 MS. BATY: I will stamp it and add that.
11 It will be -- probably be Staff Exhibit 2 which was
12 previously omitted because we were going to bind them,
13 the testimony into the transcript.

14 JUDGE KARLIN: And that is admitted into
15 the evidentiary record as an exhibit.

16 Thank you for helping us with that.

17 MS. BATY: I will do that.

18 JUDGE KARLIN: Good. Anything else? All
19 right.

20 It's show time, Dr. Wardwell.

21 JUDGE WARDWELL: Well, good morning,
22 everyone. I'd like to start off by thanking Dr.
23 Horowitz for his presentation yesterday afternoon. I
24 think that was pretty much what we were looking for
25 and appreciated the effort that you went through to

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1 introduce us to that.

2 I am now going to address other items
3 besides CHECWORKS and then get back to that later on.
4 I wanted to recognize you now so you didn't feel that
5 we were ignoring CHECWORKS and all the information
6 associated with it, but I'm really going to start my
7 questions dealing with just the definitions of flow-
8 accelerated corrosion and then how it fits into the
9 Aging Management Program before we get into the aging
10 management plan and get into the details of CHECWORKS.
11 I did want to make sure I didn't forget to recognize
12 your efforts in that.

13 And in that regard, as we go through this
14 questioning, I'd like to remind the witnesses that we
15 have read everything. We know your basic positions,
16 so we don't need to hear those again. We're well
17 aware of what they are. So it would really expedite
18 the process and also it's to your benefit because it
19 clarifies your answer if you just directly answer the
20 questions that are being asked and I think things will
21 move smoother and faster without you trying to add on
22 editorial things that you're trying to emphasize that
23 aren't related to the question necessarily that are
24 repetitious of your testimony.

25 We're asking questions that are

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1 specifically things that confused us and we need
2 clarification on. The rest of that, we're well aware
3 of what your positions are. We've spent many hours
4 reading this testimony and it's inefficient to repeat
5 that. So we would appreciate your help in that.

6 MR. WITTE: Just one question, given the
7 way the --

8 JUDGE WARDWELL: Could you speak up?

9 MR. WITTE: Yes. I would like the Court's
10 assistance in the event that you ask and I answer in
11 the territory that might be proprietary.

12 JUDGE WARDWELL: Good point. We discussed
13 that yesterday and we -- Entergy has assured us that
14 they will flag us as -- if we start to get off in that
15 area. We're as much at fault, if not more, than the
16 witnesses are if we start wandering into that area and
17 fail to remember that.

18 JUDGE KARLIN: Yes, and I think that's
19 right. And we talked about that. I just have one
20 other thing to say about that. Let's not be too
21 anxious to start talking about proprietary -- we're
22 not going to get into proprietary, we don't think.
23 But if we do, we'd like you to let us know, but we're
24 not automatically going to shut down all avenues of
25 inquiry just because somebody raises a proprietary

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1 flag. We can either go to a proprietary session or we
2 may not agree with the argument that something is
3 proprietary. So please be hesitant to start waving
4 the proprietary flag if we're not really getting into
5 it. But we'll honor that. Thank you.

6 JUDGE WARDWELL: Okay, with that said, I
7 think we'll move on in and I'd start off with some
8 questions for Entergy. I think Mr. Fitzpatrick will
9 probably be the best person who can address these
10 questions. And I'd like to start off with looking at
11 EPRI NSAC-202 which I think is Exhibit E-4-07.

12 (Pause.)

13 You would have thought I would have had
14 that pulled out considering it was my first question,
15 but I hadn't.

16 I'm really looking at the report summary
17 on little numeral five, the v. Are you there?

18 MR. FITZPATRICK: Yes.

19 JUDGE WARDWELL: And I look at the
20 background, under background, it says flow-accelerated
21 corrosion sometimes referred to as flow-assisted
22 corrosion or erosion corrosion leads to wall thinning,
23 metal loss, steel piping exposed to flowing water or
24 wet street.

25 Under vi, on the next page, under the key

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1 words for this whole document, I assume, has both
2 flow-accelerated corrosion and erosion corrosion in
3 this.

4 (Pause.)

5 I understand that it is -- what is your
6 position with regards to the definition of flow-
7 accelerated corrosion?

8 MR. FITZPATRICK: Flow loss, metal loss in
9 carbon steel piping due to a chemical process, the
10 interaction of a water environment and metal.

11 JUDGE WARDWELL: Does it include erosion
12 corrosion?

13 MR. FITZPATRICK: Not within the scope of
14 the program.

15 Everything was called erosion corrosion 20
16 years ago.

17 JUDGE WARDWELL: Sorry?

18 MR. FITZPATRICK: Everything was called
19 erosion corrosion 20 years ago, when the Surry
20 incident occurred?

21 JUDGE WARDWELL: What do you mean by
22 everything?

23 MR. FITZPATRICK: Well, a lot of unknowns.
24 The industry was learning. As time -- probably called
25 an erosion corrosion, the generic letter and the

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1 bulletin I think that erosion corrosion in the title.

2 Through time, the definition was more
3 refined to be flow-accelerated and flow-assisted
4 corrosion.

5 JUDGE WARDWELL: Referring to Dr.
6 Horowitz' and I think it's your testimony, answer 46,
7 statements made that flow-accelerated corrosion
8 definition does not include localized erosion, erosion
9 corrosion, impingement or cavitation.

10 Is that your position, Mr. Fitzpatrick?

11 MR. FITZPATRICK: Within the context of
12 the FAC program, yes.

13 JUDGE WARDWELL: Do these other
14 components, local corrosion, erosion corrosion,
15 impingement, or cavitation wear pipes?

16 MR. FITZPATRICK: Yes.

17 JUDGE WARDWELL: So pipes do thin from
18 those phenomena?

19 MR. FITZPATRICK: Yes.

20 JUDGE WARDWELL: When you perform a UT
21 test or I've forgotten exactly how you do do it, when
22 you measure wall thickness, do you use UT testing?

23 MR. FITZPATRICK: Generally, ultrasonic
24 technique measurements are taken in place.

25 JUDGE WARDWELL: When you measure that

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1 wall thickness, are you measuring flow-accelerated
2 corrosion only?

3 MR. FITZPATRICK: We're measuring wall
4 loss and --

5 JUDGE WARDWELL: Does the UT measurement
6 know whether it's flow-accelerated corrosion or
7 impingement or erosion corrosion or localized
8 corrosion?

9 MR. FITZPATRICK: No. It measures what's
10 left of the metal.

11 JUDGE WARDWELL: So it isn't very smart.
12 It doesn't know all this stuff. It just knows what
13 the thickness of the wall is.

14 MR. FITZPATRICK: Yes.

15 JUDGE WARDWELL: So why are -- and aren't
16 we concerned not with flow-accelerated corrosion wear,
17 but whether or not the pipe gets too thin?

18 MR. FITZPATRICK: That's the --

19 JUDGE WARDWELL: Regardless of how it
20 happens?

21 MR. FITZPATRICK: That is the primary
22 concern of the program.

23 JUDGE WARDWELL: If that's the primary
24 concern -- meaning that the wall does not get too thin
25 to create unacceptable limits remaining, correct?

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1 MR. FITZPATRICK: Yes.

2 JUDGE WARDWELL: So if your program is
3 concerned with that, why aren't you concerned with
4 these other phenomenon beyond flow-accelerated
5 corrosion?

6 MR. FITZPATRICK: We are concerned with
7 the other phenomenon. And they've been evaluated --
8 they've been attributed to different programs, the
9 environment, steam and vector-water systems,
10 demineralized water. There isn't any solid particles
11 in the water to cause erosion, corrosion.

12 JUDGE WARDWELL: What about cavitation or
13 turbulence? Wouldn't that have some impact on the
14 wear of the pipe?

15 MR. FITZPATRICK: Yes. Cavitation is
16 usually a design problem.

17 JUDGE WARDWELL: Well, I'm sure. If the
18 pipe gets too thin it's a design problem, but that
19 still doesn't say it isn't there, does it?

20 MR. FITZPATRICK: No.

21 JUDGE WARDWELL: Dr. Horowitz, what does
22 CHECWORKS calculate?

23 DR. HOROWITZ: The flow-accelerated
24 corrosion as I defined it yesterday. It would be
25 metal dissolution.

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1 JUDGE WARDWELL: And that is the classic
2 or the new -- I don't know if it's new -- that's the
3 very restrictive definition of only that where you're
4 -- what I like to term in my mind, you're melting away
5 the oxide layer so that another oxide layer forms and
6 then you melt that away and progressively wear the
7 pipe out. Is that a fair representation?

8 DR. HOROWITZ: That's correct, but if I
9 may, the reason that we went to a more precise
10 definition is that there is and was confusion when one
11 used erosion corrosion because the counter
12 measurements, Jim or anyone else in the industry would
13 employ, differ tremendously whether the problem is
14 cavitation, impingement, solid particle erosion or
15 flow-accelerated corrosion.

16 Also, the communications become completely
17 useless. I am convinced personally that before the
18 Surry accident, if you go through the operator
19 experience report, there was, for example, a report of
20 an erosion corrosion failure at San Onofre about '85,
21 I believe. And that, I'm sure other people reading
22 the reports say oh, he must mean cavitation or he must
23 mean something else. Nobody knew for sure.

24 So what EPRI tried to do was say let's
25 have a definition that people understand and can

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1 apply. Certainly Jim mentioned that cavitation is
2 normally considered a design issue because once we
3 experience cavitation, you don't trend wear, you don't
4 measure. We fix the problem. So EPRI has an EPRI
5 aging management tools document that says essentially
6 that. Cavitation is not aging management. It's a
7 design problem and we fix the design problem.

8 JUDGE WARDWELL: So cavitation you would
9 view as a design problem and not an aging management
10 problem.

11 What about the others, the impingement --

12 DR. HOROWITZ: The impingement is kind of
13 in the middle. If you look at some of the exhibits
14 that Entergy has provided, particularly the scoping
15 documents you will lists of operating experience in
16 various plants where they had impingement damage or
17 liquid impingement --

18 JUDGE WARDWELL: Could you describe
19 physically how that impingement wears it and is there
20 a difference between droplet impingement and general
21 impingement or --

22 DR. HOROWITZ: Normally, not. And
23 normally, impingement damage occurs when you have high
24 velocity streams of drops in steam. High velocity for
25 carbon steel is on the order of -- you need about 300

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1 feet a second. So this occurs often in heater vent
2 system where you have the pressure of the heater on
3 one side of a valve and the condenser ion the other
4 side. You have high velocity that's generated by the
5 choke flow.

6 It also occurs when you have upset
7 conditions in your extraction volume, if you have a
8 safety valve misfunctions, something like that. So
9 impingement as contrasted with the FAC tends always to
10 be much more localized, you have little holes and it
11 often occurs under upset type conditions, not normal
12 operating conditions.

13 So as far as predictable, unpredictable
14 impingement damage is basically unpredictable. You
15 never know when a steam trap is going to fail or
16 something like that. So for Vermont Yankee and other
17 places people look at operating experience, look at
18 places to inspect and fix it if they find a problem.

19 Now note that if you have impingement
20 replacing the carbon steel with stainless steel or
21 low-alloy won't solve the problem. So again, that's
22 more of a design issue, even though impingement as I
23 say is in between. If you see some damage, you may be
24 tempted to trend it for a while.

25 JUDGE WARDWELL: And would you like to add

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1 on to anything Mr. Fitzpatrick said in regards to
2 addressing erosion corrosion?

3 DR. HOROWITZ: The way I would use erosion
4 corrosion is, as I believe it was originally intended,
5 to deal with a process which has both erosion and
6 corrosion occurring.

7 JUDGE WARDWELL: Let's just call it
8 erosion then. If we're going to keep the word
9 corrosion for mean flow-accelerated corrosion, that's
10 fine. Let's then just talk about the erosion part of
11 the erosion corrosion.

12 DR. HOROWITZ: You have this phenomenon
13 mostly at entrance to heat exchangers, particularly
14 copper, copper, brass heat exchangers and what happens
15 there is the turbulence is sufficient to damage the
16 outside layer, exposed bare metal and have a process
17 where you have two different things occurring
18 simultaneously.

19 JUDGE WARDWELL: And is that not a problem
20 that needs to be addressed with Vermont Yankee as part
21 of their aging management for wearing of pipes?

22 DR. HOROWITZ: For the pipes we deal with,
23 they're carbon steel. With carbon steel, the
24 velocities necessary to cause this off-site damage are
25 much higher than you would expect to see and do see.

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1 It's not a question they're much higher. We don't see
2 that type of attack in lightwater damage.

3 JUDGE WARDWELL: Turning then to NEC for
4 a minute and probably Dr. Hopenfeld would be the best,
5 but if others think it more appropriate to answer,
6 that's fine, do you dispute any of the definitions of
7 the various components that wear a pipe that was just
8 presented by Entergy?

9 MR. HOPENFELD: Well --

10 JUDGE WARDWELL: It's a yes or no
11 question.

12 MR. HOPENFELD: Yes, I do dispute that.

13 JUDGE WARDWELL: And where do you dispute
14 that?

15 MR. HOPENFELD: Dr. Horowitz' specific
16 comment with respect to erosion corrosion and the
17 mechanism that he's talking about, it will take me
18 some time through the mechanism I dispute. I dispute
19 his definition --

20 JUDGE WARDWELL: What's your definition of
21 erosion?

22 MR. HOPENFELD: Erosion corrosion?

23 JUDGE WARDWELL: No, erosion.

24 MR. HOPENFELD: Oh, erosion --

25 JUDGE WARDWELL: Let me back up. He was

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1 portraying erosion corrosion to be a combined term
2 between the corrosion that we are now reserving to
3 mean flow-accelerated corrosion from that which is
4 caused mechanically as I interpolate him saying of an
5 erosion type of aspect. So what's your definition of
6 erosion under those assumptions that we're going to
7 reserve the word corrosion to be a shortened version
8 of FAC, flow-accelerated corrosion.

9 MR. HOPENFELD: Erosion, actually, I don't
10 even know -- it's completely separate from erosion
11 corrosion. I'll have to explain that. But strictly
12 speaking of erosion, my understanding would be you
13 have particles in steam, droplets in steam impinging
14 --

15 JUDGE WARDWELL: Is that steam droplet
16 impingement?

17 MR. HOPENFELD: Yes, that would be.

18 JUDGE WARDWELL: We separated that out.

19 MR. HOPENFELD: It could be called --

20 JUDGE WARDWELL: That's droplet
21 impingement, so back to the corrosion. If they
22 removed droplet impingement, do you agree with his
23 definition of erosion as a mechanical process --

24 MR. HOPENFELD: Not necessarily in the
25 context of corrosion and erosion, I can't separate it.

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1 I can explain to you why. You can't separate the two.
2 There is no acceptable theory as exactly what happens
3 during the erosion corrosion process. It is
4 acceptable for the last 30 or 40 years, but you don't
5 have enough shear stress, calculated shear forces
6 during normal flow. There is not enough shear there
7 to abrade or wash off, as NRC defines it, to wash off
8 that layer. There's been acceptance in the paper that
9 was written in '76 on that subject.

10 JUDGE WARDWELL: Let me stop you right
11 there.

12 It's my impression that flow-accelerated
13 corrosion isn't a physical washing off of the oxide,
14 but more of a chemical melting of it, my simplistic
15 mind, and I thought I heard Dr. Horowitz-- again, at
16 the next hearing I'm on, I'm going to limit how many
17 Hs are present for witnesses.

18 Dr. Horowitz seemed to agree to that.

19 MR. HOPENFELD: I took the next step.

20 JUDGE WARDWELL: There's no argument, no
21 one says there's enough shear forces to physically
22 remove it, but there's enough chemical action to melt
23 it, isn't there?

24 MR. HOPENFELD: No, no, no. NRC says it's
25 a washing away of the oxide.

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1 JUDGE WARDWELL: I'll get to the NRC.

2 MR. HOPENFELD: But back to what I was
3 coming to, there's no acceptable theory. There are
4 concepts. One concept I'm familiar with that has to
5 do -- that you can have very, very -- some velocity.
6 You may have sufficient, sufficient shear force. It
7 doesn't take much to affect the cohesion, to affect
8 the oxide layer. And I am not an expert on oxide
9 layer characteristics and all the details of that.
10 That's one theory. There are other theories that Dr.
11 Hausler has proposed, the creation of local extremely
12 high pressure. I'd rather he talk about that.

13 Their definition doesn't cover those acts,
14 those two acts as I just said.

15 JUDGE WARDWELL: Dr. Hausler, would you
16 like to expound on that in regards to the definition?

17 DR. HAUSLER: Yes, sir. Your Honor,
18 actually, I would. With your permission I would like
19 to cut through this fog of definition fairly quickly.

20 What this demonstrates that in fact over
21 the years the corrosion engineers have made confusion
22 in their semantics. And the chronology has developed
23 over the years. I mean perhaps to be more specific as
24 to what it is that I want to say.

25 Originally, erosion has been used for

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1 corrosion phenomena were the two extremes, were, in
2 fact, mixing with the salts, salts mixed into the
3 fluid streams. We did, in fact, then have abrasion,
4 mechanical removal of the surface layers. Now this is
5 not what we're looking at.

6 JUDGE WARDWELL: So are you saying we
7 don't have to worry about the erosion part of erosion
8 corrosion?

9 DR. HAUSLER: I think that the corrosion
10 engineers have, in fact, used erosion just like Dr.
11 Horowitz and as Mr. Fitzpatrick indicated in areas of
12 high turbulence where you have high turbulence and you
13 get somewhat localized corrosion, but without the
14 definition of what localized really means. And that
15 the corrosion engineers have identified that as
16 erosion.

17 To approach the problem, I think we would
18 be a lot better off to look maybe at the mechanism of
19 that fundamental. And here is what I would say is
20 that both are corrupt as well as what we might call
21 erosion corrosion due to high turbulence in a specific
22 location are, in fact, due to a dissolution mechanism
23 of the oxide layer on the surface. And the reason for
24 that is that very recently in Germany calculations
25 have been made with respect to the compressive

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1 strength of all kinds of corrosion product layers on
2 the surface. In order to mechanically remove with
3 flow some of these surface layers, you would in fact
4 need shear forces of the order of many megapascals and
5 actually in the order of a hundred megapascals to a
6 thousand megapascals.

7 And it is very difficult, it is extremely
8 difficult to generate sheer forces of that nature with
9 fluid. I heard Dr. Horowitz just say that it is
10 possible to do that with velocities of 300 feet per
11 second. That is a number that a long time ago had
12 been worked in Switzerland as well as by some
13 scientists, Luigi Piatti in particular, where he
14 mentioned that yes, you can cut metal with liquid
15 streams of the order of 100 or maybe 200 meters per
16 second which is in the same order of magnitude. So
17 coming back to what it is that we're actually dealing
18 with, I think, is a dissolution phenomenon that is
19 caused by the local velocity or shear force of the
20 liquid caused by turbulence effects. These turbulence
21 effects, you know, arrive as we all know from upset in
22 the flow.

23 When normally developed flow like -- say
24 develop turbulence flow and the pipe gets upset, you
25 start by some obstacle in the flow pattern. You get

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1 turbulence. You get acceleration, local acceleration
2 of the flow. The local flow rate, that increases the
3 mass transfer and that accelerates the dissolution
4 process.

5 JUDGE WARDWELL: Thank you, Dr. Hausler.

6 Turning to the staff, Mr. Rowley or Mr.
7 Hsu, whoever would like to answer this, what did you
8 consider your definition of flow-accelerated corrosion
9 when you looked at an aging management plan for
10 license renewal.

11 MR. HSU: Engineering preparing for
12 license renewal, they have flow-accelerated corrosion.
13 This flow-accelerated corrosion, what we are looking
14 at is --

15 JUDGE WARDWELL: Can you speak up?

16 MR. HSU: Dissolution outside the
17 protective field being washed away due to the flow
18 accelerator. That's what we are looking at. What
19 they are talking about is like a singularity point of
20 view, like a one point of corrosion or all those
21 happening. This is a general program. Really, you
22 cannot really look at all the small portions. They
23 point out one singularity, hostile event, due to --
24 before the design or installation, that's created some
25 kind of defect, inadequate. That's singularity point

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1 of view.

2 JUDGE WARDWELL: You're confusing me a
3 little bit. What is your definition of flow-
4 accelerated corrosion? Does it include erosion? Does
5 it include localized corrosion from turbulence? Does
6 it include droplet impingement? Does it include
7 cavitation or does it not?

8 MR. HSU: It all depends. I followed Dr.
9 --

10 JUDGE WARDWELL: What did you consider
11 when you went through your review of the application
12 for the license renewal?

13 MR. HSU: We reviewed application for
14 license renewal based on whatever the current NRC
15 endorsed the program which is consistent with the GALL
16 definition.

17 JUDGE WARDWELL: So there's a definition
18 that's in GALL?

19 MR. HSU: Yes.

20 JUDGE WARDWELL: And what is the
21 definition in GALL?

22 Before you answer that question, in your
23 testimony on -- in response to answer four on page
24 three of Staff's five, at least -- I'm not sure it's
25 appropriate, but it's your testimony -- appropriate

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1 number for that. I think I added that number. But
2 staff, your affidavit on page three for answer four,
3 the question was what is flow-accelerated corrosion?
4 And you stated flow-accelerated corrosion is also
5 known as erosion corrosion is a corrosion attack
6 accelerated by high velocity flow either washing away
7 otherwise protective films or mechanically disturbing
8 the metal itself. That seems to lead me to believe
9 you're considering both of these mechanisms when you
10 reviewed their application in regards to how concerned
11 you may or may not be in their program to manage this
12 during the aging that occurs during the renewal
13 period.

14 MR. HSU: Yes, that definition is exactly
15 like that, but also NRC's NUREG, is flow-accelerated
16 corrosion in other countries very like limited, but in
17 the U.S. people put all those two things together.

18 JUDGE WARDWELL: Okay, but that's what
19 you've answered for what is flow-accelerated
20 corrosion, so I assume that's what you were concerned
21 about when you looked at the application?

22 MR. HSU: Yes.

23 JUDGE WARDWELL: ; Do you agree with Dr.
24 Horowitz that CHECWORKS only analyzes for the chemical
25 washing away of that oxide layer, melting of that

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1 oxide layer as opposed to the mechanical. Do you
2 agree with that?

3 MR. HSU: Yes.

4 JUDGE WARDWELL: So in fact, there's no --
5 CHECWORKS does not have a potential to predict --

6 MR. HSU: CHECWORKS does not have
7 potential to predict those singularity --

8 JUDGE WARDWELL: Mechanical one.

9 MR. HSU: Yes.

10 JUDGE WARDWELL: So how did you handle the
11 mechanical one when you -- what program did they
12 recommend to you that is used to help manage the
13 mechanical wear of the pipe?

14 MR. HSU: Mechanical wear of the pipe is
15 basically like a corrosion. They have some other
16 maintenance or other type aging management program to
17 manage this type of effect, handling it like a
18 singularity problem.

19 JUDGE WARDWELL: And why is it necessarily
20 a singularity problem in regards to the mechanical
21 wearing away of the oxide layer?

22 MR. HSU: Because this involves a lot.
23 I'm certain because everybody started this erosion
24 corrosion for all those years from the knowledge-wise.
25 Some of that they can handle. Some of that, there's

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1 no easy method they can predict.

2 JUDGE WARDWELL: Can you point us to where
3 that program is that you're referring to in the
4 testimony today that's used to manage mechanical
5 corrosion?

6 MR. ROWLEY: We just discussed flow-
7 accelerated corrosion in our testimony. We don't
8 deviate and talk about any other program to handle the
9 corrosion aspect as you are asking us to show you.

10 JUDGE WARDWELL: Well, yes. That's
11 circular reasoning a bit here. You've defined flow-
12 accelerated corrosion as including the chemical
13 melting away of the oxide layer and the mechanical
14 wearing away. Then what -- and I can understand how
15 CHECWORKS might contribute to the chemical melting
16 away of the oxide layer. How did you evaluate the
17 mechanical aspects of what you defined as being flow-
18 accelerated corrosion?

19 Mr. Rowley.

20 MR. ROWLEY: We didn't address it here in
21 our testimony. We stuck with the --

22 JUDGE WARDWELL: That's what the
23 contention is about. It's relating to the aging
24 management program for flow-accelerated corrosion and
25 I've just heard testimony that says you define flow-

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1 accelerated corrosion as including both the mechanical
2 and the chemical. I can see where the chemical aspect
3 is handled. Mr. Hsu said there's other programs for
4 the mechanical one. Where are those programs that
5 relate to that portion of the flow-accelerated
6 corrosion as you, the staff, have defined it?

7 MR. ROWLEY: As I said, we didn't address
8 it here in our testimony. I have to look in the SER
9 and get back with you where we address that. I will
10 have to look.

11 JUDGE KARLIN: Well, we understand you
12 didn't address it in your testimony. This is now
13 testimony right now.

14 Did you address it in the FSER?

15 MR. ROWLEY: I'll have to check.

16 JUDGE KARLIN: Well, check right now.
17 There's no getting back. Today is the day.

18 JUDGE WARDWELL: Today is the day.

19 JUDGE KARLIN: Presumably, you're
20 familiar with the FSER. You helped write it. As far
21 as I can tell, there's only three pages in the FSER
22 that deal with this.

23 (Pause.)

24 JUDGE WARDWELL: I'd like to move on.

25 (Pause.)

1 JUDGE KARLIN: Where in the FSER -- and
2 the NRC makes a conclusion in the FSER that the flow-
3 accelerated corrosion aging management plan is
4 adequate, that NRC makes this statement that you just
5 made, Mr. Hsu that that includes both mechanical and
6 chemical. Where in the FSER is the --do you discuss
7 the mechanical flow-accelerated corrosion being
8 adequate?

9 I'm still with Mr. Rowley.

10 MR. ROWLEY: One moment, sir.

11 JUDGE KARLIN: It's page 3.15, 16, and 17,
12 I think.

13 MR. ROWLEY: Three dash --

14 JUDGE KARLIN: You don't know what page
15 this discussion is and you're a witness on the
16 subject? 3-14.

17 MR. ROWLEY: I know what the flow-
18 accelerated corrosion discusses, yes.

19 JUDGE KARLIN: Three dash 15, flow-
20 accelerated corrosion.

21 I would suggest counsel to ask their
22 witnesses to familiarize themselves with the FSER
23 section they wrote and they're going to testify on.

24 MR. ROWLEY: I do know what flow-
25 accelerated corrosion. I was trying to get to where

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1 we discuss the mechanical.

2 JUDGE KARLIN: Yes, I'm trying to find
3 that too. I don't see it there. That's my point.
4 But if you can find it.

5 (Pause.)

6 This was obviously an issue in pleading,
7 so presumably you should expect a question.

8 Do you find anywhere in the FSER where the
9 staff discussed the mechanical flow-accelerated
10 corrosion component? Yes or no.

11 MR. ROWLEY: No, not for flow-accelerated
12 corrosion, but not in conjunction with the corrosion
13 part.

14 JUDGE KARLIN: All right. Mr. Hsu, do you
15 have anything in the FSER that discusses the
16 mechanical component of flow-accelerated corrosion,
17 sir?

18 MR. HSU: We did not discuss the
19 mechanical.

20 JUDGE KARLIN: Did you think about it when
21 you concluded that they had an adequate program to
22 manage flow-accelerated corrosion? Did you just leave
23 that out?

24 MR. HSU: It's not that we didn't think
25 about it. It's --

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1 JUDGE KARLIN: Did you think about it?

2 MR. HSU: NRC endorsed it, the GALL
3 program. We are doing our audit which the NRC
4 endorsed the program. And they are doing -- follow
5 the steps, endorsed the petition.

6 JUDGE KARLIN: Staff endorsed GALL, so all
7 you did was apply GALL?

8 MR. HSU: Yes.

9 JUDGE KARLIN: Can you show me in GALL
10 where it excludes mechanical aspects of flow-
11 accelerated corrosion? Show me where it is in GALL
12 that excludes mechanical.

13 MR. ROWLEY: We don't have GALL before us,
14 Your Honor.

15 JUDGE KARLIN: You should have it. You're
16 testifying here on this issue.

17 (Pause.)

18 MR. ROWLEY: We just went through our
19 GALL, it's in elements to make sure that their program
20 --

21 JUDGE KARLIN: Show me in GALL, let me
22 know, I looked at GALL. I would just like to see
23 where it says something about this in GALL.

24 MR. ROWLEY: Sorry, sir. We don't have
25 that as an exhibit in front of us so I can't direct

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1 you to that.

2 JUDGE KARLIN: Well, let's see if we can
3 find GALL. What exhibit is that, Ms. Baty?

4 MS. BATY: I believe that the relevant
5 section of --

6 JUDGE KARLIN: I just asked you what
7 exhibit it was first.

8 MS. BATY: The relevant section of GALL is
9 Exhibit, for this topic is one of any NEC's exhibits
10 and I'm trying to locate it. I believe it is exhibit
11 NEC UW-05.

12 JUDGE KARLIN: I believe it's E-4-05.

13 MS. BATY: Is that the -- E-4-05. It may
14 be duplicated.

15 JUDGE KARLIN: I think it's duplicated.
16 E-4-05.

17 Why don't you get that out, Mr. Rowley and
18 Mr. Hsu. It's only three pages.

19 (Pause.)

20 Exhibit 4-05-VY entitled -- I guess it's
21 an excerpt from GALL, Ms. Baty?

22 MS. BATY: Yes, that's the relevant
23 program section from GALL.

24 JUDGE KARLIN: Section 11.M17 flow-
25 accelerated corrosion program description, evaluation

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1 and technical basis 1, 2, 3, 4, 10. Those are the 10
2 you were referring to, Mr. Rowley?

3 MR. ROWLEY: Yes.

4 JUDGE KARLIN: Okay. Where does it
5 exclude or cover or -- mechanical. Maybe it does. I
6 don't know.

7 (Pause.)

8 Okay. I'll withdraw the question and we
9 can continue. I mean I think it is demonstrated you
10 have not familiarized yourself with this on an issue
11 that was important in this case.

12 MR. ROWLEY: We followed this and made
13 sure that their program matched GALL and we said it
14 was consistent and --

15 JUDGE KARLIN: I asked for testimony in
16 this matter and Mr. Hsu's testimony in this matter
17 says that flow-accelerated corrosion includes both
18 mechanical and chemical. Now you're telling us that
19 your aging management plan consideration that you did
20 didn't deal with that.

21 And your answer is well, we were just
22 following GALL.

23 MR. ROWLEY: In our review, that's what we
24 did, sir.

25 JUDGE KARLIN: And GALL is guidance, isn't

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1 it?

2 MR. ROWLEY: GALL is guidance.

3 JUDGE KARLIN: It doesn't mean that's the
4 only thing you do. It doesn't mean you don't think.
5 It means you have some guidance and you use it as
6 guidance.

7 MR. ROWLEY: Correct.

8 JUDGE KARLIN: All right.

9 JUDGE WARDWELL: Mr. Fitzpatrick, does
10 your core program address mechanical corrosion?

11 MR. FITZPATRICK: It would address the
12 effects of mechanical corrosion.

13 JUDGE WARDWELL: How?

14 MR. FITZPATRICK: By inspecting. The
15 steam train reactor water systems at Vermont Yankee
16 run with demineralized water. All the water that hits
17 the reactor in the steam feed train. It passes
18 through demineralizers. There is no --

19 JUDGE WARDWELL: Is that the only
20 pipelines that we're worried about in regards to
21 corrosion?

22 MR. FITZPATRICK: Within the FAC program,
23 yes.

24 JUDGE WARDWELL: How about in the plant?
25 Are all the pipes that fall under license renewals are

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1 those that are within the -- what you just described?

2 MR. FITZPATRICK: License renewals, they
3 review different systems, like service water and
4 there's different aging mechanisms as in the program
5 for the service water system. The FAC program, the
6 scope and the FAC program, is a steam and feedwater
7 system attached with a reactor.

8 JUDGE WARDWELL: Because the steam and
9 feedwater system --

10 MR. FITZPATRICK: And extraction steam,
11 whatever all the process steam systems.

12 JUDGE WARDWELL: Sorry, you trail off at
13 the end. Enunciate your words and project them, if
14 you will. It's a lot easier to hear you.

15 MR. FITZPATRICK: Basically, all the
16 process steam systems that turn the turbine are
17 included with scope of the FAC program.

18 JUDGE WARDWELL: And are there other pipes
19 that also have flow-accelerated corrosion outside of
20 those pipes?

21 MR. FITZPATRICK: No.

22 JUDGE WARDWELL: Thank you. Turning to E-
23 4-04, which is an excerpt, I believe, from the
24 application.

25 Is that correct, Mr. Fitzpatrick?

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1 MR. FITZPATRICK: Yes, sir.

2 JUDGE WARDWELL: And I'm looking at the,
3 right under the program description. It says, first
4 sentence, the flow accelerated corrosion fact, in
5 parenthesis, program at VYNPS, is comparable to the
6 program described in NUREG 1801. Is NUREG 1801 the
7 GALL?

8 MR. FITZPATRICK: Yes, sir.

9 JUDGE WARDWELL: Further down, under NUREG
10 1801 Consistency, it says the flow-accelerated
11 corrosion at NYNPS is consistent with the program
12 described in NUREG 1801, which is again the GALL?

13 MR. FITZPATRICK: Yes, sir.

14 JUDGE WARDWELL: Do you believe that the
15 words comparable and consistent are equivalent to the
16 words identical?

17 MR. FITZPATRICK: In absolute terms, no.

18 JUDGE WARDWELL: So in fact, your program
19 could be different than GALL, but a judgment factor
20 would determine whether or not it is comparable or
21 consistent, correct?

22 MR. FITZPATRICK: That's possible, yes.

23 JUDGE WARDWELL: Who is responsible for
24 making that judgment of being comparable and
25 consistent? You, the staff, or the intervener?

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1 MR. FITZPATRICK: Us and the staff should
2 be responsible. We should be responsible making the
3 decision and the staff should review the decision. We
4 believe that's how the process works.

5 JUDGE WARDWELL: And where have you shown
6 in your application that it is, that can justify that
7 it is comparable and consistent?

8 MR. FITZPATRICK: The supporting documents
9 for the application did the review against the GALL,
10 the program review against the GALL. And those who
11 audit it, during the NRC inspection of the
12 application. They did a programs audit and
13 interviewed our programs against the GALL
14 requirements.

15 JUDGE WARDWELL: Why don't we turn back to
16 the GALL again. I think it's the next one, 05.

17 (Pause.)

18 The first line in the program description
19 says "the program relies on the implementation of
20 EPRI's guidelines in the NSAC-202L."

21 Would you agree that the GALL relies a lot
22 on the components as outlined in NSAC-202L for that,
23 the details of the program? Would you agree that it
24 relies on that for the details of the program?

25 MR. FITZPATRICK: The details no, the

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1 guidance, yes. The details are in the plant-specific
2 FAC.

3 JUDGE WARDWELL: And where is that in your
4 license application.

5 MR. FITZPATRICK: I'm not sure --

6 JUDGE WARDWELL: I can refer you to your
7 exhibit on your application which is E-4-04.

8 MR. FITZPATRICK: All the programs or
9 references consistent to the GALL and the specific
10 programs are not listed in the application.

11 JUDGE WARDWELL: So as far as the excerpt
12 that you've provided under E-4-04 is the only
13 description of the aging management program for flow-
14 accelerated corrosion that you submitted with your
15 application?

16 MR. FITZPATRICK: I believe it is.

17 JUDGE WARDWELL: Turning to -- he said
18 yes.

19 EPRI's -- and NSAC is an EPRI document, is
20 it not?

21 MR. FITZPATRICK: It was produced by EPRI
22 and it was written by the industry group, the CHECK
23 group.

24 JUDGE KARLIN: What group, sir?

25 MR. FITZPATRICK: CHECWORKS users group.

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1 It's an industry group that's been focusing on FAC
2 since 1988.

3 JUDGE KARLIN: So it's --

4 MR. FITZPATRICK: CHECWORKS users group,
5 CHUG.

6 JUDGE KARLIN: CHUG, and that's a group of
7 people who are using Mr. Horowitz, Dr. Horowitz'
8 system, is that right? CHECWORKS users group.

9 MR. FITZPATRICK: Yes, sir.

10 JUDGE WARDWELL: Turning to that on E-4-
11 07, I believe is the exhibit -- your testimony that
12 includes NSAC.

13 MR. FITZPATRICK: Yes, sir.

14 JUDGE WARDWELL: And let's turn to --
15 let's start off with page 1-3, under industry status.

16 (Pause.)

17 Are you there?

18 MR. FITZPATRICK: Yes, sir.

19 JUDGE WARDWELL: Second paragraph, third
20 line from the bottom of the paragraph, would you care
21 to read that sentence starting with "however"?

22 MR. FITZPATRICK: "However, since the
23 approach is based on the section of the prioritized
24 sample at an acceptable location, it is recognized
25 that it will never be possible vet all FAC-related

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1 leaks and ruptures from occurring."

2 JUDGE WARDWELL: I ask you now to turn to
3 page 4-5. Under 4.3.1 FAC analysis and power uprates.
4 Could you read that first sentence?

5 MR. FITZPATRICK: "It is recognized that
6 even small power uprates can have significant effects
7 on FAC leaks."

8 JUDGE WARDWELL: Given that Vermont Yankee
9 has going through a power uprate and that NSAC also
10 says regardless of the power uprate it recognizes it
11 will never be possible to prevent all leaks, as you've
12 just read, doesn't it seem reasonable that you'd want
13 to be as conservative as possible in all aspects
14 associated with your FAC program given those somewhat
15 pessimistic view of attempts to address this
16 particular phenomenon?

17 MR. FITZPATRICK: I believe we're
18 conservative in what we've done.

19 JUDGE WARDWELL: So you agree that you
20 ought to be pretty conservative at all turning points
21 in order to address this, given the cloud over which
22 NSAC emphasizes the problems with addressing this
23 particular phenomenon?

24 MR. FITZPATRICK: I believe it's
25 conservative in all the aspects we've addressed. I

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1 believe too that any aspects we have addressed are
2 significant.

3 JUDGE WARDWELL: Going back to
4 demonstrating your aging management plan and the facts
5 of it, turning to page 2-1, it's really 2-1 through 2-
6 5. There are basically six different areas that are
7 considered to be elements of an effective FAC program.

8 The first one is a corporate commitment.
9 Is that correct on that page, 2-1, 2.1 is corporate
10 commitment?

11 MR. FITZPATRICK: Yes, sir.

12 JUDGE WARDWELL: Where is your corporate
13 commitment to an effective FAC program established in
14 the license renewal application, specifically
15 demonstrating that the following recommendations that
16 are presented on 2-1 have been or will be carried out
17 during the license renewal period?

18 MR. FITZPATRICK: Specific commitments,
19 the FAC program of the license renewal period is the
20 same program that's in effect now at Vermont Yankee
21 and all the Entergy plants. It's a corporate program.

22 The commitments are the specific --

23 JUDGE WARDWELL: Have you submitted that
24 as an exhibit?

25 MR. FITZPATRICK: An exhibit, yes, we

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1 have.

2 JUDGE WARDWELL: Can you show me where
3 that -- where is the commitment -- back up again.
4 Before you show me that, where do you state in your
5 license renewal application that you're committing to
6 the previous program? We should reference that so
7 we're clear if that's part of your aging management
8 plan.

9 MR. FITZPATRICK: I would be back on --

10 JUDGE WARDWELL: It would be in E-4-04
11 would it not be?

12 MR. FITZPATRICK: The license renewal
13 application doesn't list specific programs.

14 JUDGE WARDWELL: That wasn't my question.
15 I said where was the commitment to follow your
16 existing program in that license renewal application
17 under flow-accelerated corrosion that you just
18 portrayed would be the aging management, the details
19 of the aging management program that are only roughly
20 alluded to here under the application?

21 MR. FITZPATRICK: I don't believe the
22 existing program is listed in this section of the
23 application.

24 JUDGE WARDWELL: But this is the section
25 that deals with the aging management program, does it

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1 not?

2 MR. FITZPATRICK: This is the section that
3 deals with flow-accelerated corrosion.

4 JUDGE WARDWELL: I assume to save some
5 time I was going to go through each six of those items
6 and ask where were the details of those presented in
7 your application. I assume that none of them are
8 there. Is that correct? Exclusive of -- none of them
9 are there in the section relating to the aging
10 management program.

11 MR. FITZPATRICK: I believe they're all in
12 the specific implementation program procedure.

13 JUDGE WARDWELL: Sorry?

14 MR. FITZPATRICK: They're in the specific
15 procedure that implements the program.

16 JUDGE WARDWELL: And what procedure is
17 that that is referenced in E-4-04 that you're
18 referring to?

19 MR. FITZPATRICK: It's not explicitly
20 referenced in the E-4-04.

21 JUDGE WARDWELL: Where then is it in your
22 application and where is -- can we turn to the exhibit
23 here where the existing program is outlined?

24 MR. FITZPATRICK: I'm not too sure in the
25 application if it's included.

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1 JUDGE WARDWELL: So how is one able to
2 judge or provide any assurances that, in fact, these
3 things will be carried out if there's nothing in your
4 application that says it will as part of your aging
5 management plan? I guess I don't understand.

6 MR. FITZPATRICK: It says our program will
7 be consistent with the GALL.

8 And the program, the supporting documents
9 for the application that have those documents that
10 references in it, but they're not included in the
11 application.

12 JUDGE WARDWELL: But you do agree that --
13 you are testifying that your application says you'll
14 be consistent with the GALL and you also testified, I
15 believe, that nothing in the GALL says that there's a
16 commitment or a requirement to commit to an existing
17 program.

18 MR. FITZPATRICK: No.

19 JUDGE WARDWELL: And there's no other
20 commitments either in your application and certainly
21 not in the GALL because it didn't know what your
22 program is to commit to your existing program.

23 MR. FITZPATRICK: I'm trying to understand
24 the question, sir.

25 JUDGE WARDWELL: Your application does not

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1 commit to extend the existing program as part of your
2 flow-accelerated corrosion aging management plan
3 because all it does is reference GALL. Is that
4 correct?

5 MR. FITZPATRICK: The application
6 references GALL, yes.

7 JUDGE WARDWELL: Thank you. Now, your
8 existing program. Where is your -- what exhibit is
9 your existing program?

10 MR. FITZPATRICK: I'm looking that up.

11 JUDGE KARLIN: I believe it's E-4-06.
12 It's a document. We don't know what it is, actually,
13 but it seems to be a corporate document.

14 JUDGE WARDWELL: Is that what you consider
15 to your existing program?

16 MR. FITZPATRICK: This is the program
17 procedure, yes.

18 JUDGE WARDWELL: But isn't that a
19 corporate procedure? That's not a Vermont Yankee
20 procedure.

21 MR. FITZPATRICK: It's adopted by all the
22 plants.

23 JUDGE WARDWELL: But it's not specific --
24 okay, sorry. I'll back up.

25 Let's for example take the very first

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1 proponent that's recommended by NSAC and that is the
2 corporate commitment. Where are the details of the
3 corporate commitment as applied to Vermont Yankee and
4 presented in this document?

5 MR. FITZPATRICK: The corporate commitment
6 is to have a program in place to monitor and address
7 FAC. Having the procedure satisfies that commitment.
8 I think there's a section eight that says commitments
9 --

10 JUDGE WARDWELL: I'll ask for an example.
11 2.1 under NSAC says that you will provide as part of
12 your corporate commitment the financial resources to
13 ensure that all tasks are properly completed. Where
14 is the commitment of the financial resources that
15 Vermont Yankee proposes to dedicate to this as part of
16 this program to ensure that that goal is achieved?

17 MR. FITZPATRICK: That financial
18 commitment means to have a program in place and
19 implement the program. That's the intent of that
20 commitment -- statement.

21 JUDGE WARDWELL: You as a technical
22 person, as a technical person, can you explain why you
23 feel that bare bones commitment provides a
24 demonstration that aging management will be maintained
25 during the entire period of the uprate as required by

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1 the regulations?

2 MR. FITZPATRICK: Vermont and to an
3 extent, Entergy, in response to General Letter 89-08
4 had a formal commitment that we will have a program to
5 monitor FAC and address FAC.

6 That commitment and the procedures we've
7 developed over time have been folded into this one
8 program procedure. This is a corporate program
9 procedure. Every plant has to implement this.

10 JUDGE WARDWELL: But where is the
11 demonstration that it's going to be implemented at
12 Vermont Yankee that's required of the regulations?
13 Where are the technical aspects of those?

14 MR. FITZPATRICK: This program procedures
15 defines the technical aspects of the program we have
16 to have in place.

17 JUDGE WARDWELL: I understand that. Where
18 is the site-specific -- we're now dealing with an
19 application not for a fleet of generic power plants.
20 We're dealing with Vermont Yankee. Where does it
21 apply to Vermont Yankee?

22 MR. FITZPATRICK: It should be in the FSAR
23 supplement for the license renewal.

24 JUDGE WARDWELL: Did you write the FSER?

25 MR. FITZPATRICK: No.

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1 JUDGE WARDWELL: Did Entergy write the
2 FSER?

3 MR. FITZPATRICK: No, not the FSER. F-S-
4 A-R. FSAR supplement for the application.

5 It should have the programs listed that
6 it's committed to. The aging management program
7 should be included in that. I don't have it in front
8 of me. I'll look it up.

9 JUDGE WARDWELL: Mr. Rowley of the staff,
10 where -- or Mr. Hsu --

11 JUDGE KARLIN: Can I just ask, is that
12 FSAR an exhibit here?

13 MR. FITZPATRICK: I don't know.

14 JUDGE KARLIN: And you're referring to the
15 UFSAR, I presume, the updated final safety analysis
16 report by Entergy?

17 MR. FITZPATRICK: I believe it's Appendix
18 A of the application, the FSAR changes.

19 JUDGE KARLIN: Well, maybe at the break,
20 counsel can help and can figure if that's an exhibit
21 here or not. I'm sorry.

22 MR. FITZPATRICK: No problem.

23 JUDGE WARDWELL: Mr. Rowley or Mr. Hsu,
24 you've reviewed their aging management plan and have
25 concluded from the technical standpoint that you felt

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1 there was sufficient information to demonstrate that
2 aging management will be maintained and taking place
3 during the period of extended operations. Is that
4 your conclusions in the FSER?

5 MR. HSU: Yes. Because --

6 JUDGE WARDWELL: I haven't asked a
7 question yet. Tell me what question you're answering
8 and you can go ahead and answer it.

9 MR. HSU: I just tried to paraphrase. The
10 last time you asked us about the technical and the
11 mechanical. Because FAC program uses NDE technology
12 and then check the wall thickness. When you check the
13 wall thickness you don't distinguish the loss due to
14 the chemical and do the mechanical. It's due to both,
15 the combination.

16 JUDGE WARDWELL: In fact, it would include
17 anything that wears the pipe?

18 MR. HSU: Yes, that's right.

19 JUDGE WARDWELL: Where do you measure
20 points? Do you inspect all the pipes?

21 MR. HSU: It's not all the pipes, only the
22 pipe which is FAC can be accelerate that. So they put
23 it FAC and ranking the accessibility. So that's the
24 reason.

25 JUDGE WARDWELL: Where does Entergy select

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1 those points to measure? How do they select them?

2 MR. HSU: How they select it is they are
3 just like a factor. They consider all those --

4 JUDGE WARDWELL: Let me rephrase the
5 question. Is CHECWORKS used to select the locations
6 that you inspect?

7 MR. HSU: Yes.

8 JUDGE WARDWELL: What does CHECWORKS
9 model, do you know?

10 MR. HSU: CHECWORKS model?

11 JUDGE WARDWELL: Does it model mechanical
12 erosion?

13 MR. HSU: CHECWORKS, basically, did not
14 really specific put a mechanical section like they
15 talk about the shear force.

16 JUDGE WARDWELL: But you saw those F
17 factors. Are any of those F factors that go into the
18 equations, the equation that predicts the wear rate
19 deal with mechanical erosion? Dr. Horowitz earlier
20 today testified it didn't. Do you believe it does?

21 MR. HSU: I know this model did not really
22 consider the mechanical factor, but I know when
23 they're doing the NDE --

24 JUDGE KARLIN: Please define NDE.

25 MR. HSU: NDE, wall thickness measurement.

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1 MR. ROWLEY: Non-destructive evaluation.

2 JUDGE WARDWELL: And Dr. Horowitz, did I
3 -- was I correct in saying that you testified that
4 CHECWORKS doesn't address the mechanical?

5 DR. HOROWITZ: Yes, that's exactly right.
6 And if I may, Vermont Yankee does not use only
7 CHECWORKS to select inspection location. And
8 particularly for mechanical damage the key way of
9 locating it is through operating experience of humans.
10 And so once it gets put into operating experience,
11 then inspections if they find a problem, then deal
12 with them. So CHECWORKS doesn't find the problem, but
13 operating experience does.

14 JUDGE WARDWELL: Thank you. I want to
15 clarify -- let me hang on a second.

16 (Pause.)

17 My other colleagues, I'm pausing now
18 because we've gone through the definition of FAC and
19 kind of the definition of what is in the aging
20 management program and what is not in the aging
21 management program and I thought I'd pause to see if
22 either of you have questions on it also and -- but not
23 on others, we'll move on to the others later. I think
24 it's a good opportunity to make sure we haven't missed
25 anything on this aspect. I'm afraid you guys will

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1 forgot to ask these.

2 JUDGE KARLIN: I think Dr. Wardwell has
3 raised a concern that I have and I think we all have
4 and so again I'll turn and I'm going to maybe go over
5 a little more ground, but hopefully it will clarify it
6 for me.

7 Mr. Fitzpatrick, let's go to Exhibit E-4-
8 04 which is part of your application. Now under the
9 regulations it's required that the application
10 demonstrate that aging management program will --aging
11 management will be adequately managed during the
12 period of extended operations. The application is
13 supposed to demonstrate that and that's part of what's
14 been challenged here. They're saying it hasn't
15 demonstrated that.

16 Now I'm trying to find where in the
17 application is the flow-accelerated corrosion plan and
18 is E-4-04 the sum entirety of the flow-accelerated
19 corrosion plan in the application?

20 MR. FITZPATRICK: As described in the
21 application.

22 JUDGE KARLIN: Yes, in the application.
23 The application which is supposed to demonstrate that
24 it will be adequately managed. So these page 1-8 is
25 the whole plan.

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1 MR. FITZPATRICK: It's not the whole plan.

2 What's --

3 JUDGE KARLIN: It's in the application.

4 And let me ask on the first sentence, "the
5 flow-accelerated corrosion program at Vermont Yankee
6 is comparable to the program described in NUREG 1801",
7 etcetera.

8 Next sentence, "this program applies."
9 When it says this program is it referring to the
10 immediately preceding referenced program?

11 "This program applies" -- to me, I read
12 that to say the GALL program. There are two programs
13 referred to in the preceding sentence. When this
14 sentence says "this program applies" which program is
15 it referring to?

16 MR. FITZPATRICK: The flow-accelerated
17 corrosion program at VY.

18 JUDGE KARLIN: How do we know? That
19 doesn't look like it says that to me. Okay, I'll take
20 your word for it because that's your intent anyway.

21 And this program is based on -- when it
22 says -- next paragraph. It says "the program based on
23 EPRI report NSAC-202L." Isn't that referring to the
24 NUREG program?

25 MR. FITZPATRICK: There's no NUREG --

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1 JUDGE KARLIN: Your program refers to the
2 GALL program which then refers to the EPRI program.
3 It's like Russian dolls all inside of each other, it's
4 getting smaller and smaller.

5 MR. FITZPATRICK: There is only one FAC
6 program. It's the existing program.

7 JUDGE KARLIN: This is the flow-
8 accelerated corrosion program for this license
9 application, right here, this page.

10 You've already established there's nothing
11 in the application that makes any reference to the
12 fact that you're going to adopt or use the existing
13 program. And if you've got anything on that, I'd like
14 to see it. I see you testified to that, but in the
15 application itself there's nothing said about that, at
16 least nothing you've presented to me. This is the
17 whole application right here, I guess.

18 It's astounding. There's no beef in this
19 thing.

20 Now -- hold on a second.

21 JUDGE WARDWELL: While you're looking, I
22 can ask a question --

23 JUDGE KARLIN: Yes, sure.

24 JUDGE WARDWELL: Take your time. Start
25 with Entergy. We've interchanged and you hear this a

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1 lot. Some people call it aging management program,
2 some people call it an aging management plan. In your
3 mind, is there any difference?

4 MR. FITZPATRICK: A program is something -

5 -

6 JUDGE WARDWELL: Is there an aging
7 management plan?

8 MR. FITZPATRICK: It could be a plan.
9 Programs are typically more formal.

10 JUDGE WARDWELL: Sorry? Which is?

11 MR. FITZPATRICK: You would consider a
12 program more formal than a plan in generality. We
13 have program in place. It's a program and it's got
14 procedures, requirements.

15 JUDGE WARDWELL: But when someone says an
16 aging management plan, there's nothing significant
17 about that misnomer, is there?

18 MR. FITZPATRICK: No.

19 JUDGE WARDWELL: In fact, you have
20 yesterday, I'm not sure that you were the witness, but
21 with the steam dryer, we had monitoring programs and
22 they were part of a plan. So in fact, the plan was
23 pretty formal and here's some details of it. At other
24 times, the program has plans within it. Is that
25 correct?

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1 MR. FITZPATRICK: It could be, yes.

2 JUDGE WARDWELL: So inherently, just by
3 those words, it provides no implicit representation of
4 the complexity of either of those terms. Is that fair
5 to say in an engineering sense?

6 MR. FITZPATRICK: In an engineering sense.

7 JUDGE WARDWELL: Staff, would you agree
8 that there is no real significance between whether a
9 program or a plan was used as the end of a
10 nomenclature of any given thing? It would have to be,
11 it would have to stand on its own and not rely on the
12 definition of either program or plan to exactly
13 determine its complexity or the details, etcetera?

14 MR. ROWLEY: Correct.

15 JUDGE WARDWELL: You would agree with
16 that. And NRC, would you agree that there is no
17 significant difference between those two?

18 MR. WITTE: My background in configuration
19 --

20 JUDGE WARDWELL: Speak up please and
21 enunciate.

22 MR. WITTE: Okay. My background is in
23 configuration management and issues exactly like that
24 definition that you're wrestling with. A plan, in my
25 experience, in 28 years, is a finite task to

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1 accomplish something. A program, in the vernacular,
2 in the industry, is a living program that is, does not
3 have a finite life, that is laid down until someone
4 chooses to terminate it. There are differences.

5 JUDGE WARDWELL: Is a program above plan
6 or below it or aside it?

7 MR. WITTE: Any of the three. I'm sorry
8 to answer it that way, but typically a program is a
9 higher sphered document than a plan. A plan may ask
10 for a program and a program may ask for specific plans
11 as part of that program. Now I have thoroughly
12 confused Your Honor.

13 JUDGE WARDWELL: Sure did. Sounds like
14 this is a technical area that generalities, for anyone
15 besides configuration managers, probably plan and
16 program would be one and the same and they wouldn't
17 provide, they haven't provided any implicit
18 characteristics to the resulting documents, whether it
19 was categorized as a program or a plan for the general
20 engineering community associated with nuclear power.

21 MR. WITTE: Essentially, you have to read
22 past the words to figure out what they're talking
23 about.

24 JUDGE WARDWELL: Thank you.

25 JUDGE KARLIN: Now there are a couple of

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1 questions for the staff now. I would like you to
2 refer to the FSER page 3-15, please, Mr. Hsu and Mr.
3 Rowley. Do you have that in front of you?

4 MR. ROWLEY: Yes.

5 MR. HSU: Yes.

6 JUDGE KARLIN: Great. And I would also
7 like you to refer to Exhibit E-4-04 at the same time.

8 Now this page 3-15 is the flow accelerated
9 corrosion program discussion in the FSER. Is that
10 correct, Mr. Hsu?

11 MR. HSU: Yes.

12 JUDGE KARLIN: Mr. Rowley?

13 MR. ROWLEY: Yes.

14 JUDGE KARLIN: And I would like you to
15 focus for a moment on the second full paragraph in
16 that page 3-15. The first sentence of that paragraph,
17 I would like you to compare that to the second
18 sentence in E-4-04.

19 MR. ROWLEY: It's the same, sir, except
20 for we wrote out, equated in equal two.

21 JUDGE KARLIN: So it is the identical
22 sentence except you wrote out greater than two?

23 MR. ROWLEY: Correct.

24 JUDGE KARLIN: Did you have quotation
25 marks around that when you quoted the application

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1 verbatim?

2 MR. ROWLEY: Sir, understand that the
3 section you are reading is the summary of technical
4 information of the application.

5 JUDGE KARLIN: I realize that it is a
6 summary, but I didn't realize that you were quoting
7 the application. I thought you were stating something
8 in your own words. If you were quoting it, shouldn't
9 you put quotes around it?

10 MR. ROWLEY: We may should have done that
11 --

12 JUDGE KARLIN: Let's look at the next rest
13 of that paragraph.

14 MR. ROWLEY: The whole section is from the
15 application.

16 JUDGE KARLIN: It's a summary of the
17 application, it purports to be. It doesn't purport to
18 be a quotation of the application.

19 MR. ROWLEY: Correct.

20 JUDGE KARLIN: Let's look at the rest of
21 that paragraph which starts with "the program, based
22 on Electric Power Research Institute" blah, blah, blah
23 until the end. I would ask you to look at the third
24 paragraph in the E-4-04.

25 MR. ROWLEY: Yes.

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1 JUDGE KARLIN: Isn't it true that that's
2 a verbatim quote from the application?

3 MR. ROWLEY: It is.

4 JUDGE KARLIN: And you didn't put it in
5 quotes?

6 MR. ROWLEY: We did not.

7 JUDGE KARLIN: And didn't the Inspector
8 General of the NRC take the staff to task for failing
9 to put quotation marks around parts of the FSER when
10 they were quoting?

11 MR. ROWLEY: They asked us to make sure we
12 were able to distinguish who said what.

13 JUDGE KARLIN: Right. And do you think
14 this accomplishes that?

15 MR. ROWLEY: We specifically state from
16 the application and that is contributed to --

17 JUDGE KARLIN: Where do you state that
18 you're quoting the application? It's a summary -- it
19 says summary of technical information in the
20 application. It doesn't say quotation of technical
21 information.

22 MR. ROWLEY: Right, but it's clearly
23 attributing everything there to the application.

24 JUDGE KARLIN: I think that's very
25 misleading and I think the staff should put things in

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1 quotes as the Inspector General indicated when you're
2 quoting because this is not a summary. This is a
3 quote.

4 MR. ROWLEY: We'll take that into
5 consideration.

6 JUDGE KARLIN: The NRC lawyers have
7 indicated to the Commissioners that they would try to
8 implement the recommendation of the Inspector
9 General's report and I just think you ought to have a
10 lawyer involved sometimes in working this out.
11 Because this is a quote. This isn't a summary.

12 MS. UTTAL: Excuse me, Your Honor --

13 JUDGE KARLIN: Yes.

14 MS. UTTAL: I don't think that this is
15 relevant --

16 JUDGE KARLIN: It is relevant and I'm
17 going to continue because I want to know what the
18 program is and I'm not finding out what the program
19 is. It seems to be an empty box.

20 Let's go down to the bottom of that page,
21 the penultimate paragraph, the second to the last
22 paragraph and as you say in a letter dated January 31,
23 2004, Vermont Yankee provided information. In this
24 letter, the Applicant provided its expected changes
25 and its flow-accelerated corrosion program. That's

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1 2004 flow-accelerated corrosion program?

2 MR. ROWLEY: Yes.

3 JUDGE KARLIN: What are we talking about
4 that for? The application didn't even come in until
5 2006?

6 MR. ROWLEY: They made changes to the
7 power uprate.

8 JUDGE KARLIN: This is not the uprate.

9 MR. ROWLEY: Right, but it gets tied into
10 license renewal because they are --

11 JUDGE KARLIN: How is it tied into license
12 renewal? Does the application say that they're going
13 to use that program?

14 MR. ROWLEY: No. Maybe not. It's
15 explicitly stated in the application that the program
16 they're currently using is the one they're going to
17 use. It's an existing program, sir.

18 JUDGE KARLIN: It's an existing program.

19 MR. ROWLEY: Correct.

20 JUDGE KARLIN: And it expires when the
21 license expires in 2010, 2012, right?

22 MR. ROWLEY: 2012. And if it's renewed it
23 carries forward.

24 JUDGE KARLIN: How do we know it carries
25 forward? How do I know it carries forward?

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1 This paragraphs talks about -- there's a
2 reference in it "flow-accelerated corrosion program"
3 right?

4 MR. ROWLEY: Yes.

5 JUDGE KARLIN: Next paragraph. And then
6 it says "the staff noted that the selection criteria
7 were based in part on checklists."

8 Next page, page 3-16, first paragraph. Is
9 that paragraph discussing a flow-accelerated corrosion
10 program that you're talking about that was submitted
11 in 2004? The staff verified that the flow-accelerated
12 corrosion includes applicable acceptance criteria.

13 MR. ROWLEY: No, that's the current --

14 JUDGE KARLIN: Wait a minute, "the staff
15 verified that the flow-accelerated corrosion program"
16 -- that's the one that you were referring to in the
17 preceding paragraph?

18 MR. ROWLEY: That's the one from the
19 application from the preceding paragraph.

20 JUDGE KARLIN: Well, you had a capitalized
21 word in paragraph -- on page 3-16: flow-accelerated
22 corrosion program. Now later two paragraphs later you
23 use that same word, capitalized, flow-accelerated
24 corrosion program, so I assume you're referring to the
25 same program?

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1 MR. ROWLEY: Yes, it is the same program.

2 JUDGE KARLIN: And then that paragraph
3 says "the staff finds this approach for aging
4 management to be acceptable because it is in
5 conformance with GALL." Right?

6 MR. ROWLEY: That's correct.

7 JUDGE KARLIN: So you're finding that
8 their 2004 program meets GALL?

9 MR. ROWLEY: No, the current program.

10 JUDGE KARLIN: The current program, okay.

11 MR. ROWLEY: Because 2004, there were some
12 changes made to the program due to the power uprate
13 and that carries forward. Because when you increase
14 by 20 percent --

15 JUDGE KARLIN: All right, so it's the
16 current program, the one that they're using for their
17 current license that expires in 2012?

18 MR. ROWLEY: Right.

19 JUDGE KARLIN: And so the discussion in
20 the next paragraph, based on this review, the staff
21 concludes the program elements for the Applicant's
22 flow-accelerated corrosion program, all caps, provide
23 an adequate basis to manage. Again, you're referring
24 to the current program?

25 MR. ROWLEY: Correct.

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1 JUDGE KARLIN: And the next paragraph
2 you're also referring to the current program?

3 MR. ROWLEY: Yes.

4 JUDGE KARLIN: And we've already
5 established, is there anywhere in this FSER where you
6 reflect the fact that the current program will be
7 binding upon them for the period of extended
8 operation?

9 MR. ROWLEY: It's not stated --

10 JUDGE KARLIN: You don't state it
11 implicitly either, do you?

12 MR. ROWLEY: Well, we know this is their
13 application, this is what they --

14 JUDGE KARLIN: You know that?

15 MR. ROWLEY: To review.

16 JUDGE KARLIN: Is it in the application
17 that they'll do that? Is it in the FSER that they'll
18 do that?

19 MR. ROWLEY: No, sir --

20 JUDGE KARLIN: Is it in the license
21 commitment? Fifty-one license commitments of Appendix
22 A of the FSER. Is it in there that they commit to do
23 that?

24 MR. ROWLEY: I have to see. They put it
25 into the UFSAR and that's binding.

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1 JUDGE KARLIN: They put it into the UFSAR.

2 What does that mean?

3 MR. ROWLEY: They --

4 JUDGE KARLIN: That's in their report.

5 It's not a commitment, is it?

6 MR. ROWLEY: It is part of their --

7 JUDGE KARLIN: It's a report they submit
8 to you.

9 MR. ROWLEY: Correct.

10 JUDGE KARLIN: Is it a license condition?

11 MR. ROWLEY: It's --

12 JUDGE KARLIN: Is there anywhere in the
13 commitments --

14 MR. ROWLEY: I can check. They have
15 committed to do certain programs and their commitment
16 list -- let me review it and I will see if the flow-
17 accelerated corrosion program is one of those.

18 (Pause.)

19 No, that's not one of the programs they
20 have committed to implement for --

21 JUDGE KARLIN: All right, is it anywhere
22 in the licensing condition, Section 1.7 --

23 MR. ROWLEY: No, it's not an explicit
24 commitment to do the flow-accelerated corrosion
25 program, neither are any of the other programs that we

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1 asked them.

2 JUDGE KARLIN: Could you speak up?

3 MR. ROWLEY: Neither are any of the other
4 programs not just --

5 JUDGE KARLIN: Well, there are a lot of
6 commitments. There's 51 of them.

7 MR. ROWLEY: Correct. For them to -- they
8 didn't necessarily have to commit to an existing
9 program. They're already doing it. The CLB says that
10 what they're doing today, our license renewal
11 principle is what they're doing today, as far as the
12 current licensing basis will carry forward into the
13 period of extended operation if granted. That's how
14 it works.

15 I don't know -- that's just part of our
16 license renewal principles. It's a new license.
17 What's in their present license is updated. We modify
18 it a little bit and that new license contains old
19 stuff plus this new stuff of license renewal and
20 carries forward.

21 JUDGE KARLIN: So everything in their
22 current license goes over to their new license --

23 MR. ROWLEY: Correct.

24 JUDGE KARLIN: And no one has to say that?

25 MR. ROWLEY: The license itself states

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1 that because we don't change other than adding to it.
2 We don't delete anything.

3 JUDGE KARLIN: But the application has to
4 demonstrate that they will manage aging. I don't see
5 it in the application.

6 MR. ROWLEY: We perform the review of
7 their program which they just gave a description of
8 the program. It's not a lengthy, drawn out -- because
9 if they were to do that applications would come in.

10 JUDGE KARLIN: Who big is the application?
11 A hundred pages?

12 MR. ROWLEY: Over a thousand.

13 JUDGE KARLIN: A thousand pages and you're
14 worried about being too lengthy and drawn out?

15 MR. ROWLEY: Well, it would be
16 superfluous.

17 JUDGE KARLIN: Oh.

18 MR. ROWLEY: To put all this stuff in. We
19 know we're going to do audits. We go and we look at
20 the documentation. Maybe not the public, but yes, we
21 do.

22 JUDGE KARLIN: You know, but as you say
23 the public doesn't know, do they?

24 MR. ROWLEY: No.

25 JUDGE KARLIN: And we don't know. I don't

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1 have any more questions.

2 Do we want to take a break? Why don't we
3 take a break. It's 10:05. We will take a 15-minute
4 break. We stand adjourned.

5 (Off the record.)

6 JUDGE KARLIN: We're now back on the
7 record. I would remind the witnesses you're still
8 under oath please and we will continue with the
9 questioning.

10 JUDGE WARDWELL: Mr. Fitzpatrick,
11 returning back to the EPRI NSAC-202L E4-07, page four,
12 Section 4.3, pages four to five of that section.

13 MR. FITZPATRICK: Section 4.3? I missed
14 that.

15 JUDGE WARDWELL: Yes, it's -- I have
16 Section 4.3. Yes, page 4-5. I'm sorry. That's where
17 my confusion was. Yes. Section 4.3, page 4.05 of
18 E04-07 and it says, "It has recognized that even small
19 power applies." I'm sorry. That's the wrong quote
20 here. I apologize. Yes, at the very top of that
21 right under "Performing FAC Analysis." It says, "Once
22 susceptible large bore piping systems have been
23 identified, it is recommended that detailed FAC
24 analysis be performed by CHECWORKS" I think is what
25 the sentence basically says. How are small bore

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1 piping systems handled?

2 MR. FITZPATRICK: Small bore piping
3 systems, all the piping systems are identified as FAC
4 susceptible or not in a susceptibility screen and --
5 for the CHECWORKS or a -- All the small susceptible
6 small bore piping becomes a population that's
7 addressed under the program and --

8 JUDGE WARDWELL: Under the --

9 MR. FITZPATRICK: -- under the FAC.

10 JUDGE WARDWELL: Okay.

11 MR. FITZPATRICK: Locations on those, the
12 small bore piping, generally are from found community
13 dispute disparities. We started inspecting small bore
14 lines in '93 and '95 for NSAC guidance on small bore
15 resolving. They are based on a majority of the small
16 bore inspections in the '93 and '95 time frame.

17 JUDGE WARDWELL: This might be a good time
18 and I didn't have it on my question list at this stage
19 and I know it's further in those question lists. But
20 rather than dig out my question, Dr. Horowitz
21 references earlier also that there are things besides
22 CHECWORKS that dictate where an inspection will be
23 done and there are other things in the program besides
24 CHECWORKS. CHECWORKS isn't the end-all or be-all of
25 the management program. There are some factors. Do

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1 you remember those off the top of your head? If you
2 don't, that's fine. I'll get to it and I'll have a
3 reference for it.

4 MR. FITZPATRICK: Yes. Industry
5 experience is one. Previous inspection data in the
6 plant from previous inspections we identified a
7 component should be. We inspected CHECWORKS modeling
8 for large bore. Maintenance records, we find out the
9 valves and leaking. We put the piping -- and
10 inspection and scope in the next outage and ensure
11 that there's no damage. OE is a big thing. OE is,
12 operational experience you impose. You use quite a
13 bit.

14 JUDGE WARDWELL: Okay. Thank you. On
15 page 4-7, I'm mean Figure 4-7 on page 425. Yes.
16 Figure 4-7 shows a relationship between plant
17 operating time and component fitness. And in that
18 diagram, it shows a range of UT inaccuracies and
19 illustrates their point that they're trying to
20 illustrate there.

21 MR. FITZPATRICK: Yes.

22 JUDGE WARDWELL: My question deals with
23 has that error analysis for UT testing been determined
24 at Vermont Yankee.

25 MR. FITZPATRICK: We count the defects of

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1 the error, the possible error, in UT analysis in a
2 wear rate predictions prompt actual data. We put a
3 1.1. In the past, they put a 1.2 factor in the old
4 procedure. We use a 1.1 factor on the wear rate
5 calculated for the number of measured inspections --

6 JUDGE WARDWELL: So that 1.1 came from
7 this range of UT inaccuracies.

8 MR. FITZPATRICK: Yes, that was an
9 intended item and I think it was included in the
10 section below there, Safety Factor 473.

11 JUDGE WARDWELL: I'm sorry. Where are you
12 pointing to?

13 MR. FITZPATRICK: The same -- Page 425.

14 JUDGE WARDWELL: Yes.

15 MR. FITZPATRICK: Right below there. The
16 predicted wear, when you get into predicted wear you
17 put a safety factor on it to -- You measure where you
18 put a safety factor on the measured wear for your
19 predicted thickness.

20 JUDGE WARDWELL: So you say you increase
21 -- Did you say by ten percent?

22 MR. FITZPATRICK: Ten percent.

23 JUDGE WARDWELL: Ten percent.

24 MR. FITZPATRICK: Currently ten percent
25 from the beginning to mid 20.

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1 JUDGE WARDWELL: Okay. But that's a
2 safety factor. Do you have the actual plus or minus
3 accuracy of your UT measurements?

4 MR. FITZPATRICK: On the instruments that
5 we've been using with data that is published it is
6 plus or minus 0.004 inches.

7 JUDGE WARDWELL: And what are the wall
8 thicknesses? In relation to the wall thicknesses?

9 MR. FITZPATRICK: Feedwater, 16 inch
10 feedwater is 1.216. Eighteen inch feedwater is 1.375.

11 JUDGE WARDWELL: What's your thinnest
12 design pipe?

13 MR. FITZPATRICK: Design pipe, the small
14 bore could be like one quarter inch thick.

15 JUDGE WARDWELL: But no thinner than one
16 quarter inch.

17 MR. FITZPATRICK: Typically, they might --
18 I mean it's three quarter inch lines and we get into
19 a real small line maybe like three-sixteenths.

20 JUDGE WARDWELL: Okay.

21 JUDGE REED: Did I understand that the
22 accuracy of the ultrasonic testing was 0.004 of an
23 inch?

24 MR. FITZPATRICK: Plus or minus 0.004 as
25 published in the regional -- EPRI.

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1 JUDGE REED: Thank you.

2 JUDGE WARDWELL: Going on to Section 4.9
3 on page 427 to 428, the first paragraph end of the
4 third line down, the sentence starts, "It is
5 recommended that only one safety factor be used in the
6 process and that it be applied when determining
7 fitness for continued service and the reinspection
8 interval." Would you elaborate more on what that
9 means? What does that safety factor at Vermont
10 Yankee?

11 MR. FITZPATRICK: That's 1.1 on the
12 predicted fitness. You take a measurement at a
13 refueling outage and you calculate the wear from
14 either previous measurements or methods recommended by
15 EPRI that have been demonstrated to show some
16 conservatism or wear. Then you apply the safety
17 factor of the predicted thickness at the next outage.
18 I call it peak predicted. So you always predict the
19 wear an outage ahead to make sure that it's still
20 going to -- if we have wear it will meet the Code in
21 the next outage. You're always looking one cycle
22 ahead when you do this.

23 JUDGE WARDWELL: And --

24 MR. FITZPATRICK: The -- Excuse me.

25 JUDGE WARDWELL: I'm sorry.

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1 MR. FITZPATRICK: The concern is if you
2 started adding factors all along the way it just
3 mushrooms out like the diagram. You start getting all
4 possibilities.

5 JUDGE WARDWELL: And both factors that
6 you're referring to are the factors that Dr. Horowitz
7 put up on the screen yesterday.

8 MR. FITZPATRICK: No. That's totally
9 different.

10 JUDGE WARDWELL: Okay. What are they?

11 MR. FITZPATRICK: This is addressing the
12 measured wear.

13 JUDGE WARDWELL: The wear.

14 MR. FITZPATRICK: You're predicting wear
15 from measurements.

16 JUDGE WARDWELL: This is strictly the
17 inspection program. Nothing to do with the analysis
18 program.

19 MR. FITZPATRICK: No, sir.

20 JUDGE WARDWELL: Thank you.

21 MR. FITZPATRICK: Yes, sir, for your
22 question.

23 JUDGE WARDWELL: I understood. I knew
24 which way you were answering that.

25 You don't have to refer to this, but I

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1 believe that in your Exhibit E4-01 on page three you
2 mention that either the aging management program or
3 CHECWORKS applies only to carbon steel and yet I saw
4 somewhere that people also reference low-alloy steel.
5 Is there a real significance with that? Do you have
6 much low-allow? Does, in fact, the program address
7 both or does it only address carbon steel? What's the
8 deal with low-allow steel?

9 MR. FITZPATRICK: The FAC is generally
10 carbon steel. If you have low-alloy steel, it
11 significantly reduces the potential for FAC. It's not
12 an absolute theory that it will never be in FAC. But
13 the protected wear rates are much, much less.

14 JUDGE WARDWELL: Dr. Horowitz, did you do
15 the modeling at Vermont Yankee or --

16 DR. HOROWITZ: No, sir.

17 JUDGE WARDWELL: Sorry.

18 DR. HOROWITZ: No, sir, I did not.

19 JUDGE WARDWELL: Mr. Fitzpatrick, in the
20 CHECWORKS modeling at Vermont Yankee, was it ever
21 applied to low-alloy steels?

22 MR. FITZPATRICK: Yes.

23 JUDGE WARDWELL: In a way that would still
24 be conservative?

25 MR. FITZPATRICK: Yes. It actually

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1 predicts wear in low-alloy steels at times and --

2 JUDGE WARDWELL: And do you see that those
3 end up being corrected a lot due to the actual
4 measurements that the program supposedly does?

5 MR. FITZPATRICK: Yes. If you put in --
6 Early on, we did -- When CHECWORKS first came out, we
7 did inspections on low-alloy steel. We weren't seeing
8 any wear and it shows up in the CHECWORKS model where
9 all the components show long-time wear -- times the --
10 which is a measure of time (Inaudible.)

11 JUDGE WARDWELL: At a constant power
12 level, how long does it take the program to self-
13 correct itself with the various inspections that are
14 performed until it really focuses in on the --
15 prediction?

16 MR. FITZPATRICK: In a CHECWORKS model?

17 JUDGE WARDWELL: Yes.

18 MR. FITZPATRICK: It would depend on how
19 it modeled it, what you modeled it, whether it was
20 modeled in separate sections where -- The way we break
21 up the CHECWORKS models is the same chemical
22 processes, the same temperature conditions, the same
23 flow conditions. There are certain sections where
24 there is a few components, two or three components, in
25 that line there's enough to do it. Other sections

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1 where there's a lot of piping, you may do more
2 inspections data.

3 JUDGE WARDWELL: Okay. We'll get into
4 that in more detail probably after lunch now. I still
5 want to stay with mostly just what's here and what's
6 in the aging management plan.

7 In your Exhibit 4-09, page three, and this
8 exhibit is a "Declaration of Neal Wilmshurst in
9 Support of EPRI's Opposition To Motion to Compel,"
10 page nine, page three, I'm sorry, it says, "CHECWORKS
11 is" -- on number 11, it says, "CHECWORKS is not
12 recommended for use in the prediction of FAC in pipes
13 smaller than two inches in diameter." How do you
14 handle the two inches in diameter pipes?

15 MR. FITZPATRICK: Throw them in a lump
16 into the small bore program where we don't do
17 CHECWORKS analysis. We just inspect.

18 JUDGE WARDWELL: Is there a -- Where are
19 the details of that program spelled out in the license
20 renewal application?

21 MR. FITZPATRICK: In the application
22 specifically by reference to the existing FAC program.

23 JUDGE WARDWELL: Thank you. Sorry. No
24 thank you.

25 MR. FITZPATRICK: It explicitly is not in

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1 the license renewal application, but it's quite an
2 existing factor.

3 JUDGE WARDWELL: It's consistent with your
4 position that's embedded in all the documentation
5 somewhere with regards to reference to continuing with
6 the existing inspection program.

7 MR. FITZPATRICK: Yes.

8 JUDGE WARDWELL: Question 15, yes. I
9 mean, the paragraph 15 I guess is what this is. It
10 states that "No other person has within or without
11 EPRI has access to CHECWORKS source code or
12 mathematical algorithms." Dr. Horowitz, what is meant
13 here by "the mathematical algorithms"?

14 DR. HOROWITZ: Basically, those f-factors
15 as shown here, a series of factors, what goes into
16 making them f-1, for example.

17 JUDGE WARDWELL: So the information in and
18 how you derive those f-factors are the algorithms and
19 not the ultimate wear equation we saw yesterday.

20 DR. HOROWITZ: I think the way they're
21 using it here would be both. It means both are the
22 means basically to form a partner statement. The
23 equation we use is the equation I showed. What's
24 proprietary is what makes up those individual factors.

25 JUDGE WARDWELL: Again, we'll get into

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1 more of those details and what those things are this
2 afternoon.

3 In NEC's rebuttal, they're maintaining
4 that there should be no distinction between leaks and
5 ruptures. I assume you believe differently and, if
6 so, would you like to explain why aren't we concerned
7 with leaks as well as the ruptures?

8 MR. FITZPATRICK: In an generic sense or
9 a specific sense?

10 JUDGE WARDWELL: We'll start with Mr.
11 Fitzpatrick. Mr. Fitzpatrick, I dodged.

12 MR. FITZPATRICK: We are concerned about
13 the leaks. We are concerned about the ruptures. But
14 I'm trying to think of the context where they're
15 saying -- A major leak is not a program -- A little
16 leak is not a program failure. Power plants do have
17 small drain lines that do leak on occasion and they're
18 addressed and small leaks in non-safety piping have
19 occurred, probably will occur in the future, but they
20 don't affect the safety of the plant.

21 JUDGE WARDWELL: Are leaks in non-safety
22 piping -- Do they fall under the aging management
23 review?

24 MR. FITZPATRICK: If they're critical to
25 the piping in the FAC program, yes, they do.

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1 JUDGE WARDWELL: If they are what?

2 MR. FITZPATRICK: All leaks in any plant
3 system are addressed. The plant has to address them.
4 The piping that falls under the program that I've been
5 working on, we have to find, there were no corrective
6 action process, find out why it's leaking and then
7 come up with a compensatory measure for that.

8 JUDGE WARDWELL: But not all pipes fall
9 under aging management, do they?

10 MR. FITZPATRICK: All the pipes I can
11 guess the ones in the FAC do.

12 JUDGE WARDWELL: You're driving me around
13 in circles.

14 MR. FITZPATRICK: I'm sorry, sir. I'm
15 just --

16 JUDGE WARDWELL: What piping falls under
17 aging management review? I think you testified
18 earlier today. I just don't want to quote you because
19 I'll quote you wrong.

20 MR. FITZPATRICK: Thanks.

21 JUDGE WARDWELL: I'll look at the
22 transcript.

23 MR. FITZPATRICK: I'm not familiar with
24 the entire scope of the aging management program and
25 the entire scope for the license renewal application.

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1 I deal with the FAC program and the piping there. I
2 know of some other piping. The service water piping
3 is under an aging management program.

4 JUDGE WARDWELL: So to cut to the quick,
5 you didn't select the types that are in the FAC
6 program. You have implemented the FAC program for the
7 pipes that were given to you.

8 MR. FITZPATRICK: No. I think you drilled
9 down a little bit too much. Up here, we identified
10 what's in the scope of the FAC program in the
11 susceptibility evaluation and we looked at all the
12 piping in the plant. This is before the license
13 renewal application. You screen all the piping in the
14 plant and identify what should be in the FAC program.

15 JUDGE WARDWELL: And in that
16 susceptibility program, what made the grade to be part
17 of the FAC program?:

18 MR. FITZPATRICK: This criteria in NSAC-
19 202L and the screening criteria --

20 JUDGE WARDWELL: Can you refer us to that?
21 (Off the record discussion.)

22 JUDGE WARDWELL: Four-zero-seven.

23 MR. FITZPATRICK: I have the older
24 version, too. Yes, the Section 4.2, Identifying
25 Susceptible Systems and the criteria, you go through

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1 each of the systems and see if it fits one of these
2 criteria. You screen -- You take all the piping and
3 you screen it again around the program based on the
4 criteria in Section 4.22.

5 JUDGE WARDWELL: Mr. Rowley.

6 MR. ROWLEY: Yes.

7 JUDGE WARDWELL: Am I pronouncing that
8 right by the way?

9 MR. ROWLEY: Yes, you are. Rowley.

10 JUDGE WARDWELL: Thank you. Do you
11 consider all the piping that makes this criteria in
12 4.22 to be part of the aging management program?

13 MR. ROWLEY: Yes, we did a scope and
14 screening methodology review and determined that what
15 they had put in scope for this go-around was asked.

16 JUDGE WARDWELL: Are you confident that
17 it includes all the safety piping at a minimum?

18 MR. ROWLEY: Yes.

19 JUDGE WARDWELL: Thank you.

20 What do you do about, Mr. Fitzpatrick, the
21 small leaks that you say you are concerned about but
22 really aren't in the aging management program or the
23 FAC program, I should say?

24 MR. FITZPATRICK: The piping that's within
25 the -- The piping is in the program. You said the

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1 leaks were in the program?

2 JUDGE WARDWELL: So all leaks are in the
3 program.

4 MR. FITZPATRICK: The leaks in the piping,
5 there are different aging management programs. Piping
6 falls within this program. We were concerned about
7 leaks.

8 JUDGE WARDWELL: So if it makes the NSAC
9 susceptibility criteria and it's in the program, any
10 leaks associated with that would, in fact, be
11 addressed by your FAC program but would be restricted
12 in regards to the smaller stuff related to strictly
13 inspections when you get piping so small that
14 CHECWORKS really doesn't assist you in that evaluation
15 of its integrity.

16 MR. FITZPATRICK: Yes, that would be fair.

17 JUDGE WARDWELL: Thank you.

18 I believe in the application -- Let's turn
19 to it. I'm not 100 percent sure it's there. But I'm
20 interested in some repairs that were made in 1995. Is
21 that referred to in the application? I happened to
22 reference that and I just don't know why I referenced
23 that as I turn to it.

24 (Off the record discussion.)

25 I don't know why I referenced it. But

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1 anyhow --

2 MR. FITZPATRICK: -- Appendix B on Exhibit
3 E4-04 and it was cited as an example of operating --

4 JUDGE WARDWELL: Okay. So you say it's in
5 Appendix B to that.

6 MR. FITZPATRICK: Well, Appendix B, the --
7 program we were discussing before and it cited an
8 example of operating scheme.

9 (Off the record discussion.)

10 JUDGE WARDWELL: I have another one. I
11 have a question. Yes. What were those repairs and
12 why were they conducted? That's what I wanted to
13 know.

14 MR. FITZPATRICK: That was the 1995 per
15 month to replace both low-pressure turbines and
16 turbine casings with a FAC resistant material. The
17 piping going from a high-pressure turbine to a low-
18 pressure turbine had been showing FAC wear. We had
19 been done periodic inspections and repairs.

20 At the same time, the moisture separators
21 that go between the high-pressure turbine was modified
22 to take out more moisture. Then we saw wear and we
23 did an inspection, alone we probably had 95, to build
24 any piping wall thickness on the inside that was below
25 the required thickness of the design basis.

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1 JUDGE WARDWELL: In your testimony to
2 answer 18, that should be on page 10-11. It says the
3 FAC program includes several activities and it goes on
4 to describe what those are and then references the use
5 of CHECWORKS. Is CHECWORKS the only program that can
6 be used to do any of these analyses?

7 MR. FITZPATRICK: No.

8 JUDGE WARDWELL: There are other programs
9 out there.

10 MR. FITZPATRICK: Commercially available,
11 not to my knowledge.

12 JUDGE WARDWELL: Dr. Horowitz.

13 DR. HOROWITZ: Yes, there are. There are
14 what I would call two similar products. One is the
15 BRT-CICERO Program which was issued about ten years
16 ago by EDF, Electricite de France, and there's a
17 program by AVERA called COMSY, C-O-M-S-Y. There's
18 also a Russian program. I think it's called REMEK.
19 I think it's in Mr. Wilmshurst's affidavit which I
20 have heard described but I don't really know if it's
21 a commercial product.

22 JUDGE WARDWELL: Mr. Fitzpatrick, why did
23 you select CHECWORKS?

24 MR. FITZPATRICK: Because it's industry
25 accepted guidance and there needs to be consensus to

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1 use CHECWORKS.

2 JUDGE WARDWELL: Do you know of any other
3 plant that has used any other program but CHECWORKS in
4 the United States>

5 MR. FITZPATRICK: Early on, some of the
6 plants had different models or some programs were
7 developed themselves. I'm not too sure, but I think
8 everybody -- didn't know the status, but I think all
9 the plants have adopted CHECWORKS.

10 JUDGE WARDWELL: Dr. Horowitz, have you
11 cornered the market in the United States in regards to
12 this aspect in the industry's need?

13 (Laughter.)

14 DR. HOROWITZ: Yes. All the nuclear units
15 in the United States, Canada and Mexico use CHECWORKS
16 now as well as a few plants in Europe and some in
17 Asia.

18 JUDGE WARDWELL: Thank you.

19 Mr. Horowitz, in your answer of 18, part
20 of it says that there has to be some baseline
21 inspections performed prior to those inspections
22 performed to confirm predictions from CHECWORKS.
23 Correct?

24 DR. HOROWITZ: The --

25 JUDGE WARDWELL: No, Mr. Fitzpatrick. Did

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1 I say Mr. Horowitz?

2 MR. FITZPATRICK: You said Horowitz.

3 JUDGE WARDWELL: I meant Mr. --

4 MR. FITZPATRICK: Yes, those inspections
5 have been on-going since 1989.

6 JUDGE WARDWELL: If you change a power
7 rate, do you have to change your baseline inspections?

8 MR. FITZPATRICK: No.

9 JUDGE WARDWELL: And why not?

10 MR. FITZPATRICK: Let me clarify my
11 answer. I'm not changing how I'm inspecting. I am
12 changing the number of inspections since we did the
13 power uprate so I have more data to calibrate the
14 models recognizing that some things are going to
15 change in the model. We've added more inspections
16 since we've started as of the power uprate than we did
17 prior to power uprate. That's to get more data to
18 feed into CHECWORKS and to have more data with power
19 uprate flows to develop a level of confidence in
20 measured and predicted wearing.

21 JUDGE WARDWELL: Didn't we talk about
22 earlier this morning how CHECWORKS is or flow
23 accelerated corrosion is very sensitive to power
24 uprates?

25 MR. FITZPATRICK: That's one sentence and

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1 insight and that could be for one particular line with
2 the phase changes. Some lines, I've seen power uprate
3 studies in other plants where other lines change
4 nothing. Other lines go up significantly. Other
5 lines go down.

6 JUDGE WARDWELL: So you don't have any
7 idea what's going to happen at the power uprate at any
8 given line until it happens, until you actually
9 perform it.

10 MR. FITZPATRICK: No. Most of the single
11 phase changes I've seen in proportion with velocity
12 given everything else is similar. So prior to going
13 with power uprate we started -- we were going to
14 factor -- we've taken all existing data and factored
15 the wear rates calculated from the measured data by 25
16 percent reject total. We trend data from actual
17 inspection measurements. We don't use CHECWORKS for
18 trending wear.

19 JUDGE REED: You used a term I don't
20 understand, the word "line." It was also used in your
21 presentation yesterday, Dr. Horowitz. Would you
22 explain what is a "line"? And is it a line of piping
23 or tell me what.

24 DR. HOROWITZ: In CHECWORKS, a line or an
25 analysis line is a collection of components. In

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1 practice, it's a piece of piping from here to here and
2 possibly a parallel bit as well. But it's chosen by
3 methodology as I discussed very briefly yesterday.
4 The attributes of a line should be it has the same
5 water chemistry and roughly the same temperature along
6 the line. So we feel that any determent wear or wear
7 rate in any individual component in that line is
8 relatable to any other component in that line and
9 experience backs that up.

10 JUDGE REED: They are all experiencing the
11 same wear rate.

12 DR. HOROWITZ: No. They will not. They
13 will -- The wear rate they will experience will differ
14 by the local geometry.

15 JUDGE REED: And then I didn't understand.
16 What's -- You said they were relatively -- the same
17 relative to each other.

18 DR. HOROWITZ: Okay. They --

19 JUDGE REED: What's the reason to group
20 something, a connection of components, into something
21 called a line?

22 DR. HOROWITZ: Okay. If you think back
23 about one of the slides I showed yesterday, the one
24 with the simplified equation, with the number of
25 factors, it seems reasonable and this is what we did

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1 20 years to say that the greater number of factors in
2 common between different components the more accurate
3 the comparisons were. The more accurate comparisons
4 would be among the components in the line.

5 So let's take an example. Let's have
6 constant diameter line that has an elbow, that has a
7 45-degree elbow, has a valve, has a reducer,
8 something, whatever. The components in that line will
9 have the same dissolved oxygen, will have the same pH,
10 will have the same temperature, will have the same
11 flow rate. So in that case what's different is the
12 local velocity with the changes and what we call the
13 geometry factor which is specific to a type of
14 fitting. Okay. So a 90-degree elbow wears a little
15 more than a 45-degree elbow. A pipe downstream with
16 a valve wears more than a 90-degree elbow. So by
17 taking data on that analysis line and comparing
18 inspections, we have done everything possible to
19 minimize the random scatter inherent in the growth and
20 process.

21 So what the analyst does is by breaking
22 the plant into lines analyzes looking at comparisons.
23 If the comparison is good, the analyst says, "Well, if
24 the comparison is good for the sample of inspection --
25 inspected in the line, I can reasonably expect good

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1 predictions of the other components. If, on the other
2 hand, there isn't good comparison, then the analyst
3 either has to take more inspections or try to
4 understand what's going on. And this is kind of a
5 continuing process.

6 (Off the record comment.)

7 JUDGE WARDWELL: Mr. Fitzpatrick, when you
8 first were back talking about these baseline
9 inspections, did you -- was CHECWORKS implemented when
10 the plant first started up in the '70s?

11 MR. FITZPATRICK: No.

12 JUDGE WARDWELL: It wasn't.

13 MR. FITZPATRICK: No, there was no
14 CHECWORKS program.

15 JUDGE WARDWELL: So at some point you
16 installed CHECWORKS and started using it. Is that
17 correct?

18 MR. FITZPATRICK: Yes.

19 (Off the record discussion.)

20 JUDGE WARDWELL: Were you there at the
21 time that it was first implemented?

22 MR. FITZPATRICK: Yes, sir.

23 JUDGE WARDWELL: Did you do baseline
24 inspections at that time?

25 MR. FITZPATRICK: We had been doing --

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1 There was a predecessor, two predecessor programs to
2 CHECWORKS, CHEC, CHECMATE and CHECWORKS and CHEC came
3 out late '87, early '88 after the Surry and it could
4 handle single phase piping.

5 JUDGE WARDWELL: And did you install that
6 at Vermont Yankee?

7 MR. FITZPATRICK: You don't install it.
8 You analyze it on a computer.

9 JUDGE WARDWELL: That's fine. Yes.

10 MR. FITZPATRICK: We use that to help
11 select the first set of inspections right after -- the
12 first set of inspections.

13 JUDGE WARDWELL: Okay, and how many of
14 these inspections were considered? What makes a
15 inspection a baseline inspection as opposed to
16 inspections to confirm predictions? Are they more
17 frequent to start with that you gain several of these
18 to get a feeling for what the variability of your data
19 is and then use some average value of that to start
20 the feedback program or the baseline condition that
21 you establish when you first set up the CHEC or
22 CHECWORKS model?

23 MR. FITZPATRICK: You start adding data
24 into CHECWORKS and it counts when that data is
25 included and it will factor all that into the wearing

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1 calculation.

2 DR. HOROWITZ: Along with that, I want to
3 clarify the terminology. I think by baseline
4 inspection Jim means first inspection and in one
5 previous addition to then CHEC we talked about initial
6 inspection which is perhaps a better term than
7 baseline because initial inspection could be how a
8 component that's been in service for a number of years
9 and has a degradational record. Baseline to me
10 implies that the component hasn't been exposed to
11 service. So it's brand new.

12 JUDGE WARDWELL: But there's really not
13 much significance. The day you start using this
14 program, I mean, the day you first start taking
15 measurements the pipe is what it is and --

16 DR. HOROWITZ: No. Excuse me. I'm just
17 clarifying the terminology.

18 JUDGE WARDWELL: Right. Fine. We can
19 call it initial or baseline whichever we want to.
20 Where I'm getting at is did you only take one set of
21 measurements for your initial/baseline inspection or
22 did you take several spread out over a period of time
23 short enough that you don't expect any wear but long
24 enough so that you get -- you're sure you're not --
25 sure you're having fresh remeasurement to indicate the

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1 error bar around your measurements. That's what I
2 interpret to be what initial/baseline inspections
3 would be used for.

4 MR. FITZPATRICK: Yes. We're taking
5 multiple measurements of certain components and we're
6 taking peak inspections and slope. There are two
7 pieces to this. We do some of the peak inspections on
8 components and we inspect more components. So that's
9 a combined database.

10 JUDGE WARDWELL: Every time you're dealing
11 with a new component that hasn't been measured before
12 and isn't part of a line within CHECWORKS or is in a
13 line but now is an area that's all of a sudden come up
14 as susceptible to flow accelerated corrosion.

15 MR. FITZPATRICK: (Inaudible.)

16 JUDGE WARDWELL: Okay.

17 MR. FITZPATRICK: All the components will
18 be considered as susceptible in that line.

19 JUDGE WARDWELL: Okay.

20 MR. FITZPATRICK: You can put inspection
21 data like the components and it will take the initial
22 predictions and factor them into measured wear. And
23 as you add components, it just adds more data to
24 improve that correlation where you can take -- You end
25 up with a better correlation than you predicted. So

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1 it's depicted to the measure with more data.

2 JUDGE WARDWELL: But I thought you said as
3 you add components.

4 MR. FITZPATRICK: Over time. You do so
5 many inspections or an outage. The next --

6 JUDGE WARDWELL: So your components are
7 datapoints or results from inspections?

8 MR. FITZPATRICK: Yes.

9 JUDGE WARDWELL: I view components as what
10 I thought Dr. Horowitz was saying make up a line.

11 MR. FITZPATRICK: No. Wait a minute.
12 Each component has inspection data associated with it
13 and there's a dataset for that component and that's
14 tracked. For example, an elbow. Back in '90, we
15 measured the elbow. In '95, I measured the elbow
16 again. In 2001, I may have measured that again. So
17 I have three sets of data for that one elbow.

18 JUDGE WARDWELL: At three sets of data,
19 which is your initial/baseline data? Which is your
20 predictive data to refine prediction?

21 MR. FITZPATRICK: The only thing we need
22 for credit is the actual data. The predictive,
23 whatever comes out of CHECWORKS is what comes out of
24 CHECWORKS. Sometimes there was a discrepancy between
25 -- CHECWORKS generally shows you have more wear than

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1 what we're actually seeing in the --

2 JUDGE WARDWELL: Okay. Let me try to
3 explain it another way. You're going to add a
4 component in to your measurements. You're going to
5 start taking measurements of a component starting
6 today.

7 MR. FITZPATRICK: Yes.

8 JUDGE WARDWELL: And it's never been
9 measured before. But all of a sudden you're going to
10 do that for whatever reason. To input into CHECWORKS,
11 you need to install a thickness, a wall thickness, to
12 start with. Is that correct?

13 MR. FITZPATRICK: Yes.

14 JUDGE WARDWELL: Dr. Horowitz?

15 MR. FITZPATRICK: We put in -- We've
16 modeled all the piping with the design thickness.

17 JUDGE WARDWELL: Okay.

18 MR. FITZPATRICK: That's our initial
19 point.

20 JUDGE WARDWELL: Regardless of when you
21 first took your first measurement.

22 MR. FITZPATRICK: Well, at time zero, we
23 put it in. The plant was modeled using the standard
24 piping properties.

25 JUDGE WARDWELL: But you didn't start

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1 measuring until years after it was operational.

2 MR. FITZPATRICK: Yes.

3 DR. HOROWITZ: What you put in the case of
4 Vermont Yankee is the normal practice which is that
5 you start inspecting this given elbow. What Jim puts
6 into the program is a matrix of thickness measurements
7 corresponding to a grid.

8 JUDGE WARDWELL: And those are actual
9 measured.

10 DR. HOROWITZ: Those are actual
11 measurements, yes.

12 JUDGE WARDWELL: That's my point. Okay.
13 So you are putting in the thickness at the time you
14 started this effort.

15 MR. FITZPATRICK: Yes.

16 JUDGE WARDWELL: Is that one measurement
17 of the thickness or is it several measures of the
18 thickness so that you eliminate some of the
19 variability and you have a better estimate of what
20 that initial thickness is? That's where I'm trying to
21 get to.

22 DR. HOROWITZ: Typically, it's one
23 measurement and normally procedures, Vermont Yankee's
24 procedure, calls for a review of the data by an
25 engineer before that information is put in. So you'll

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1 see a point that looks odd, looks high, looks low.
2 Then you'll normally have it reinspected before the
3 data is entered in the program.

4 JUDGE WARDWELL: But it won't be sensitive
5 enough to indicate the variability and the accuracy of
6 the ability to measure that thickness at that given
7 location in the plant.

8 MR. FITZPATRICK: I think we're touching
9 on two different subjects. The data that's put into
10 CHECWORKS is usually the minimum measurement of all
11 the measurements on that pipe and that's what you use
12 to put into CHECWORKS.

13 JUDGE WARDWELL: So you measure the pipe -

14 -

15 MR. FITZPATRICK: Inspection data. I've
16 been putting the minimum measurements in, the most --
17 in the worse case.

18 JUDGE WARDWELL: Dr. Horowitz, you really
19 like that approach I can see.

20 JUDGE KARLIN: Do you agree with that, Dr.
21 Horowitz?

22 DR. HOROWITZ: No. The data is what we
23 put in the matrix and the program can manipulate that
24 in various ways of the operator. I think, Jim, maybe
25 you're referring to --

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1 JUDGE KARLIN: Could you refer to him as
2 Mr. Fitzpatrick because for the record please?

3 DR. HOROWITZ: Sorry. Mr. Fitzpatrick is
4 referring to a step before that. There are --
5 Virtually all large bore measurements are made on a
6 grid, normally a square grid pattern, on the
7 components. There are two general philosophies that
8 were used. Some units will measure, put the
9 transducer right on the X that is the inspection
10 location. So thickness here is what it is. The data
11 logger writes it down. Puts the transducer on every
12 X on a component. The other --

13 JUDGE WARDWELL: And that's one
14 measurement.

15 DR. HOROWITZ: At each point.

16 JUDGE WARDWELL: To start with at each
17 point.

18 DR. HOROWITZ: Yes.

19 JUDGE WARDWELL: And there is -- What I'm
20 understanding from you, Mr. Fitzpatrick, is that you
21 don't measure that. You don't take the measurement
22 instrument, go out of the room, come back in again and
23 measure it at -- try to measure it at that same point
24 again, two or three times to get some indication of
25 the variability of your capabilities to measure it.

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1 MR. FITZPATRICK: At the same time on the
2 same day?

3 JUDGE WARDWELL: I don't care whether it's
4 -- I just don't want it to be -- You don't sit there
5 and press a button three times, but you try to
6 replicate you coming into that location and putting
7 that instrument on there.

8 MR. FITZPATRICK: That's why you put the
9 grids on and you put the grids on the pipe so you can
10 always get to the same location.

11 JUDGE WARDWELL: But you can't get to the
12 same location with the grids. There's a finite
13 thickness of everything. There's going to be --
14 You're not going to get it right over that every time.
15 Different operator. Whatever. There is going to be
16 some variability in your measurement.

17 MR. FITZPATRICK: Yes. There is
18 variability and --

19 JUDGE WARDWELL: Do you make any attempts
20 to try to quantify the variability of any single
21 measurement? That's what I'm trying to get at.

22 MR. FITZPATRICK: In the wear rates
23 predicted from that. We'll take --

24 JUDGE WARDWELL: No.

25 MR. FITZPATRICK: Okay.

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1 JUDGE WARDWELL: Answer my question. No
2 is an answer. If it's no, it's no.

3 MR. FITZPATRICK: I can say the answer is
4 yes, but I don't --

5 JUDGE WARDWELL: Here's the pipe.

6 MR. FITZPATRICK: Yes.

7 JUDGE WARDWELL: Here's my measuring
8 device. I measure the -- The thickness is X. Do I
9 live with that or do I come right back to that same
10 grid point and try to measure it again to come up with
11 X prime and then do I come back again and measure it
12 to come up with X prime and then that's double prime
13 and then say, "Okay. Gee, my variability, just my
14 ability to measure the thickness is such and such with
15 this particular technique and these particular
16 operators."

17 MR. FITZPATRICK: At VY, the inspectors
18 put the UT program a grid square. They'll do 100
19 percent search of that square. They move the probe
20 around and the data logger will always refer to the
21 lowest one and they'll go back in and find out, "Yeah,
22 that's the lowest one I found" and then press the
23 button and it goes into a data log.

24 JUDGE WARDWELL: And then do you ten
25 minutes later after sending the operator away from

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1 that location send them back and repeat that same
2 process to see what your variability is and able to
3 measure the thickness at any given point in time?

4 MR. FITZPATRICK: No.

5 JUDGE WARDWELL: Thank you. So to me that
6 says that your baseline inspection is a single
7 measurement process.

8 MR. FITZPATRICK: Yes.

9 JUDGE WARDWELL: That will help you
10 better.

11 MR. FITZPATRICK: The process itself, they
12 have a calibration block where they're calibrating --

13 JUDGE WARDWELL: I'm aware of that. The
14 calibration is a different thing than the ability to
15 reproduce the value.

16 MR. FITZPATRICK: Yes.

17 JUDGE WARDWELL: So when we start talking
18 about CHECWORKS this afternoon and we're talking about
19 the wear rates that are derived from inspection
20 programs, we know they have an error bar, that the
21 actual measurement has an error bar, around it and we
22 don't know what that error bar is. It has to be -- It
23 will be sugared out as the CHECWORKS long term
24 eventually incorporates that and the plus and minus
25 will go around whatever the mean is. But any one data

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1 point we don't know what that is and that's yes,
2 right, Mr. Horowitz?

3 DR. HOROWITZ: Yes.

4 JUDGE WARDWELL: I mean no, Mr.
5 Fitzpatrick.

6 MR. FITZPATRICK: Yes.

7 JUDGE WARDWELL: And from what I
8 understand you were saying and why you got the
9 somewhat unusual reaction from Dr. Horowitz is that at
10 Vermont Yankee you never go to one grid point. You
11 always go to a grid area and find the minimum.

12 MR. FITZPATRICK: Yes. I think we might
13 have been confusing --

14 JUDGE WARDWELL: Even though other people
15 like Dr. Horowitz is sometimes go to grid points. You
16 go to grid areas and look for the lowest.

17 MR. FITZPATRICK: Some of the confusion is
18 I think coming out from the inspections and what
19 action is for the checklist. That's where I'm --

20 JUDGE WARDWELL: Yes, I tried to mean it
21 all inspections, but I --

22 MR. FITZPATRICK: Yes. There are two
23 aspects. I think we have to talk about them
24 separately.

25 JUDGE WARDWELL: I'm only talking about

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1 measurements. We ain't at CHECWORKS yet.

2 DR. HOROWITZ: May I? Two points. One,
3 a second way of doing it is as Mr. Fitzpatrick
4 described in doing 150 sent scan. Secondly, some
5 operators occasionally will have done exactly what you
6 said and send an inspector team out to inspect an
7 elbow and then send another team out and the
8 comparison is about what you would expect. You have
9 the normal kind of distribution between the two sets
10 of --

11 JUDGE WARDWELL: Yes, and I'm surprised
12 that would take place. Again, no one really --

13 MR. FITZPATRICK: We had our people verify
14 inspection methods, anything we will sample. The
15 people that run the inspection program will on
16 occasion sample. There's no required specific "you
17 shall, we do 16 percent of these." But we do do on
18 occasion re-verify this especially when Engineering
19 looks at the data.

20 JUDGE WARDWELL: And what's your error
21 around your measurements from that?

22 MR. FITZPATRICK: From the published data
23 it's plus or minus --

24 JUDGE WARDWELL: No, I'm not interested in
25 the public data. I know what the instrument can

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1 reproduce. But that's the instrument sitting on a
2 gauge block turned on three or four times. I'm
3 interested in --

4 MR. FITZPATRICK: All right. And --

5 JUDGE WARDWELL: What happens when
6 different operators go out and try to replicate each
7 other?

8 MR. FITZPATRICK: Very similar. They're
9 a decimal place typically.

10 JUDGE WARDWELL: Thank you. How often are
11 the inspections performed to confirm to predictions
12 now?

13 MR. FITZPATRICK: It depends on the
14 results. If, say, the inspection data at time A shows
15 a type is greater than design thickness, we would
16 schedule it, reschedule an inspection be further out
17 in time. If it was less than, it's kind of
18 programmatic in the procedure depending on the
19 inspection results, we schedule inspections further
20 in. If it's any thinner, we inspect it closer,
21 sooner, than we would if it was advanced.

22 JUDGE WARDWELL: What's the -- Where does
23 most of this piping come in and how often could it be
24 inspected if one had unlimited budgets and unlimited
25 labor, etc.?

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1 MR. FITZPATRICK: You could only do this
2 during refueling outages. We have to go into areas,
3 the boiling water reactors, you know, around the
4 turbine bay, the radiation field in the reactor
5 building. So during an outage, they have to put
6 scaffolding in, pull the insulation, unwrap the pipes,
7 do the inspection, evaluate the data, assemble all if
8 it's acceptable, put everything back together and go
9 to the next one. It's a process all these plants
10 have.

11 JUDGE WARDWELL: And do you wait until the
12 end before you update your information both in regards
13 to your database for the measured wear rates and to
14 incorporate that data into CHECWORKS?

15 MR. FITZPATRICK: Yes. It's screened in
16 the beginning just to get the data to get a level
17 power plant. Two engineers review the data, say it's
18 acceptable to put the insulation back on the pipe and
19 then we start working on the before and after --

20 JUDGE WARDWELL: What are your requirements
21 for how soon after the data is collected that it has
22 to be updated into the program?

23 MR. FITZPATRICK: There was a specific
24 time limit on certain aspects in the other program and
25 the new program I'd have to look up the time.

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1 (Off the record comment.)

2 JUDGE KARLIN: May I ask a question, Mr.
3 Fitzpatrick? We're asking about the frequency of how
4 often the inspections are done. Is it every refueling
5 outage the pipe is measured for purposes of CHECWORKS?

6 MR. FITZPATRICK: Piping is inspected
7 every outage. Not every pipe is inspected every
8 outage.

9 JUDGE KARLIN: I understand not every pipe
10 every outage, but are there measurements done for
11 purposes of CHECWORKS at every refueling outage?

12 MR. FITZPATRICK: We have data that's
13 taken every outage and whether it's imported into
14 CHECWORKS or not we have data. We have actual data
15 for the components.

16 JUDGE KARLIN: So you take measurements
17 or -- Is the answer yes? You do measurements at every
18 refueling outage.

19 MR. FITZPATRICK: Yes.

20 JUDGE KARLIN: Do you enter that data in
21 CHECWORKS after every refueling outage? No.

22 MR. FITZPATRICK: No, sir.

23 JUDGE WARDWELL: And why not?

24 JUDGE KARLIN: Why not?

25 MR. FITZPATRICK: If the data shows us no

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1 wear and I have conservative predictions in CHECWORKS
2 saying there is wear if I base future inspections on
3 the CHECWORKS model that has a high wear rate, I
4 should be having conservative --

5 JUDGE KARLIN: So what's the -- So
6 somebody makes a judgment on whether to enter it into
7 CHECWORKS or not.

8 MR. FITZPATRICK: I did, yes.

9 JUDGE KARLIN: And what is the criterion
10 for that judgment no wear?

11 MR. FITZPATRICK: That's what I --

12 JUDGE KARLIN: And what is the definition
13 of no wear?

14 MR. FITZPATRICK: Well, the previous
15 inspection data shows no wear or you have a very, very
16 large time that we --

17 JUDGE KARLIN: By no wear, you mean the
18 measurement is identical to the prior measurement.

19 MR. FITZPATRICK: For equipment. I put a
20 -- on that. Put minimum wear on that.

21 JUDGE KARLIN: I see.

22 JUDGE WARDWELL: And where was that
23 derived from?

24 MR. FITZPATRICK: It's in the VT-7028, the
25 previous procedure, and it's also the existing

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1 procedure which is --

2 JUDGE WARDWELL: No, I was interested in
3 how you derive that error --

4 MR. FITZPATRICK: The '05 number that I
5 just pointed out, it's a factor on the wear.

6 JUDGE WARDWELL: I would have to look at
7 your statement. Obviously, I can remember what your
8 statement was. I can't remember what you were
9 referring to.

10 MR. FITZPATRICK: I'm not clear of the
11 question.

12 JUDGE WARDWELL: It's not overly pleasing
13 to back up the transcript.

14 JUDGE KARLIN: Maybe this is the question.
15 I don't know. But every refueling outage you take
16 measurements of the pipe with what? What kind of
17 instrument?

18 MR. FITZPATRICK: Ultrasonic thickness
19 measure.

20 JUDGE KARLIN: Ultrasonic something.

21 MR. FITZPATRICK: UT.

22 JUDGE KARLIN: UT. And for every
23 refueling outage you take measurements of some pipes,
24 not the same pipe every time, but some representative
25 presumably sampling of the pipes.

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1 MR. FITZPATRICK: Yes.

2 JUDGE KARLIN: And then you make a
3 decision whether to enter that into CHECWORKS. Right?

4 MR. FITZPATRICK: Yes.

5 JUDGE KARLIN: And the decision is based
6 upon whether it shows no wear. There's no wear. Then
7 you don't enter it into CHECWORKS. Right?

8 MR. FITZPATRICK: There's no decision --
9 Sometimes we have time to --

10 JUDGE KARLIN: Sometimes you do.
11 Sometimes you don't.

12 MR. FITZPATRICK: -- you don't. Yes.

13 JUDGE KARLIN: And by no wear, is there a
14 -- I asked a question. By no wear do you mean the
15 exact same measurement and you said no. There could
16 be a band there and that's the error band I believe
17 Dr. Wardwell was asking about.

18 JUDGE WARDWELL: Yes. An error. You said
19 it.

20 JUDGE KARLIN: So what is the band? If
21 it's not exactly the same, what if it's X plus -- I
22 mean, what's the error range of the band?

23 MR. FITZPATRICK: In our inspection
24 reports, we use 0.005.

25 JUDGE WARDWELL: Okay, and where did that

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1 derive from?

2 JUDGE KARLIN: 0.005 inches?

3 MR. FITZPATRICK: It's bigger. 0.005
4 inches. The same measurements. I'm always biasing
5 towards somewhere.

6 JUDGE KARLIN: Okay.

7 MR. FITZPATRICK: And that's bigger than
8 the 0.004 in the published data and I had been doing
9 that since 1999.

10 JUDGE KARLIN: How many feet of piping are
11 we talking about, linear feet, that are safety
12 related, whatever --

13 JUDGE WARDWELL: That are in the FAC
14 program.

15 JUDGE KARLIN: -- in the FAC program?

16 MR. FITZPATRICK: Lineal feet, it may not
17 be a good measure because we concentrate on elbows and
18 fittings where there is --

19 JUDGE KARLIN: Right.

20 MR. FITZPATRICK: Safety related, I'd say
21 it's less than five percent of the program.

22 JUDGE WARDWELL: Well, how many were
23 covered by -- Just how many feet? Linear feet?

24 MR. FITZPATRICK: Thousands.

25 JUDGE WARDWELL: Thousands.

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1 MR. FITZPATRICK: Thousands.

2 JUDGE WARDWELL: Okay.

3 (Off the record comments.)

4 JUDGE KARLIN: Dr. Horowitz, do you have
5 a --

6 DR. HOROWITZ: No, I'm just wanted to be
7 sure that Mr. Fitzpatrick is talking safety related
8 and non-safety related.

9 JUDGE WARDWELL: Okay. We're talking if
10 that's in the FAC.

11 JUDGE KARLIN: Say thousands of linear
12 feet of piping safety related.

13 MR. FITZPATRICK: Right. I would estimate
14 that the safety related is less than five percent of
15 that.

16 JUDGE KARLIN: So how many feet of piping
17 safety related?

18 MR. FITZPATRICK: Safety related?
19 Feedwater.

20 JUDGE KARLIN: Fifty? Three? Five
21 hundred? One thousand?

22 MR. FITZPATRICK: Around five hundred
23 feet.

24 JUDGE KARLIN: And how many measurements
25 are taken at each refueling outage? Ten? Twenty?

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1 Fifty? Two thousand?

2 MR. FITZPATRICK: Large bore we have been
3 taking --

4 JUDGE KARLIN: What kind?

5 MR. FITZPATRICK: Large bore.

6 JUDGE KARLIN: Large bore, yes.

7 MR. FITZPATRICK: We have been taking 25,
8 30, 35 prior to EPU. As we've increased the number,
9 we've been taking 50s. We've done one outage I think
10 we had 49.

11 JUDGE KARLIN: Does the aging management
12 plan specify how many measurements would be taken?

13 MR. FITZPATRICK: No.

14 JUDGE KARLIN: Why not? Is it a judgment
15 call?

16 MR. FITZPATRICK: Yes.

17 JUDGE KARLIN: Whose judgment?

18 MR. FITZPATRICK: The FAC program engineer
19 and the basis for including inspection components is
20 documented in the scoping document every outage, why
21 some things are included, why aren't they included.
22 Every refueling outage has a scoping development, why
23 you're inspecting things, what data you evaluated and
24 reasons for including them in the inspection program
25 or putting in future inspections and that's documented

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1 when it's done after every refueling outage to go to
2 the next outage.

3 JUDGE WARDWELL: And just so we don't have
4 to keep on repeating this in future questions this
5 afternoon if it comes up every time you reference a
6 procedure like that we can safely assume that it's not
7 delineated in your aging management plan and your
8 application but it's abstractly linked as you describe
9 for other types of things earlier to --

10 MR. FITZPATRICK: The application doesn't
11 explicitly say the existing FAC program but the intent
12 is the existing FAC program is the FAC program and we
13 will do a FAC program.

14 JUDGE KARLIN: But does the existing FAC
15 program, the one that is exhibit here, does that say
16 50 locations or ten locations? It doesn't say at all,
17 does it? So even the existing FAC program does not
18 specify the number of samples or number of
19 measurements that are done at each refueling outage.

20 MR. FITZPATRICK: No.

21 JUDGE KARLIN: Okay.

22 JUDGE WARDWELL: Why not update CHECWORKS
23 after each refueling outage? What's the labor effort
24 to do that?

25 MR. FITZPATRICK: A couple months. Two or

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1 three months depending on how many different systems
2 were inspected.

3 JUDGE WARDWELL: So it takes one person
4 two or three months to input.

5 MR. FITZPATRICK: You have to have someone
6 else to review it. It's taking the data, evaluating
7 the data, getting that into CHECWORKS into the
8 database and then doing wearing analysis. So there's
9 a lot of front end work on doing the actual wear rate
10 analysis once the data is put into CHECWORKS. You
11 know, the amount of systems we have, it takes a lot of
12 work to get that done.

13 JUDGE WARDWELL: I still -- But even if
14 you waited, then you're going to have twice the data
15 the next time.

16 MR. FITZPATRICK: And the results --

17 JUDGE WARDWELL: And it still has to be
18 done at some point. Right?

19 MR. FITZPATRICK: Yes.

20 JUDGE WARDWELL: All the data eventually
21 gets in there. Correct?

22 MR. FITZPATRICK: It all eventually gets
23 in there, yes, and currently it's up-to-date.

24 JUDGE WARDWELL: Is that purely
25 coincidental that we're holding this hearing at this

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1 time in anticipation of that question or is it
2 anticipation of that question?

3 MR. FITZPATRICK: I'm anticipating that
4 question.

5 JUDGE WARDWELL: There. You're honest.
6 I appreciate that in that regards.

7 MR. FITZPATRICK: They have -- In the past
8 few years -- eventually has been putting in the model
9 and we have a dedicated FAC engineer and his job is
10 just the FAC program.

11 JUDGE KARLIN: May I ask? When you said
12 a couple months, how long is a couple? Does that mean
13 one person working full-time for two months if that's
14 what it takes or -- Is that what it means?

15 MR. FITZPATRICK: If that's about the time
16 it takes, you have to close out --

17 JUDGE KARLIN: That's how much work is
18 involved? Two months? A person working two months at
19 a time?

20 MR. FITZPATRICK: It could be less. It
21 could be less, could be more, depending on how much
22 data you have to put in.

23 JUDGE KARLIN: Okay.

24 JUDGE WARDWELL: But again, there's no
25 efficiencies gained by waiting to do an all in one

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1 fell swoop after three refueling outages. It's going
2 to take three times the amount of time after three
3 refueling outages.

4 MR. FITZPATRICK: Yes.

5 JUDGE WARDWELL: So your total labor is
6 going to remain the same regardless of when you
7 updated pretty much.

8 MR. FITZPATRICK: Yes.

9 JUDGE WARDWELL: Moving on, turning to
10 staff, I'm interested in what you did for a review of
11 this aging management program in a little bit more
12 depth. Have you reviewed the -- Has the staff audited
13 their current FAC program?

14 MR. ROWLEY: Yes, we have.

15 JUDGE WARDWELL: And who did that?

16 MR. ROWLEY: When we performed the audit -

17 -

18 MR. HSU: Okay, I was the audit member and
19 I observed all the work of the basic program and we
20 have a lot of staff which already checked it out to
21 some other place.

22 JUDGE WARDWELL: So you were a member.
23 Was it all NRC staff or was it also contracted out to
24 do this audit?

25 MR. HSU: All NRC staff and the parties

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1 contract out. So team composed of the NRC staff and
2 the contractor.

3 JUDGE WARDWELL: And as a result of your
4 review, has Entergy demonstrated consideration of all
5 those ten elements that were brought up in the
6 standard review plan for license renewals for the FAC
7 program?

8 MR. HSU: Yes.

9 JUDGE WARDWELL: They have considered all
10 of that.

11 JUDGE KARLIN: May I ask? When did this
12 audit take place that you are referring to?

13 MR. ROWLEY: There were five audits. So
14 that would have been --

15 JUDGE KARLIN: Just give me the dates of
16 all five.

17 MR. HSU: We will have to get them for
18 you.

19 JUDGE KARLIN: Give me the last three.

20 MR. ROWLEY: The last one was January '08.

21 JUDGE KARLIN: Okay.

22 MR. ROWLEY: And then December '07 and
23 then the one prior to that was then August -- I would
24 have to get back to you with an exact date.

25 JUDGE KARLIN: No, that's fine. Two are

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1 relatively recent. Thank you.

2 JUDGE WARDWELL: And are those completely
3 fresh new audits or are those replications of each
4 other or are different aspects?

5 MR. ROWLEY: This one was new and they are
6 different measures each audit. They might have
7 touched on the same aging component program twice but
8 just with different aspects of it.

9 JUDGE WARDWELL: In your audit review,
10 recognizing that it's not expected that the FAC
11 program will indicate all leaks, were there anything,
12 any steps, that the Applicant was taking to help
13 assure you that they tried to quantify how likely
14 these leaks are that will not be predictive and to
15 benchmark their program and to improve on their
16 abilities to correlate the actual wear to the
17 CHECWORKS model?

18 MR. HSU: Those portions, we forget about
19 them. It's implementation of the program and wishing
20 that -- which is a regional office and what we are
21 looking at is this adequate of the program and we
22 reviewed the adequacy of the program and we think the
23 program which is adequate to reasonable assurance of
24 safety of the plant in the implementation portion
25 which is regional. It's doing the computers

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1 inspection.

2 JUDGE WARDWELL: Thank you. Turning to --
3 We'll look it up first to make sure.

4 JUDGE KARLIN: Are any of these audits
5 reflected in your discussion of flow accelerated
6 corrosion program in the FSER? If so --

7 MR. HSU: I think it's the audit sheet --

8 MR. ROWLEY: We have the audit report,
9 sir, that discusses what happens in an audit and as
10 you see we state that the audit report details --
11 evaluation of this ANP in the FSER. So we in turn
12 spoke to the audit report for more specifics than what
13 you see here.

14 JUDGE KARLIN: Okay. So is there a
15 reference in the FSER to the fact that you've audited?
16 You've conducted these audits?

17 MR. ROWLEY: Yes. Right here, Staff
18 Evaluation, second sentence.

19 JUDGE KARLIN: Of what page? I'm sorry.

20 MR. ROWLEY: Of page 3-15.

21 JUDGE KARLIN: Three-15, okay.

22 MR. ROWLEY: In section, Staff Evaluation,
23 underlined Staff Evaluation.

24 JUDGE KARLIN: Which paragraph, sir?

25 MR. ROWLEY: Third paragraph.

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1 JUDGE KARLIN: Third paragraph.

2 MR. ROWLEY: Second sentence.

3 JUDGE KARLIN: Okay. Third paragraph,
4 Staff Evaluation. "During the audit and review,
5 Staff..." Okay. So that's "during its audit and
6 review, the Staff reviewed the Applicant's claim."
7 Okay. So which audit was that?

8 MR. ROWLEY: It might have been -- We have
9 -- I can't remember the exact date, but our process is
10 we go and do a time limit age analysis audit, an aging
11 management program audit and aging management review
12 audit. This would have been done through the aging
13 management program audit which would have been the
14 application came in in January 2006. So it would have
15 been six months after that. So July --

16 JUDGE KARLIN: Of '06.

17 MR. ROWLEY: '06.

18 JUDGE KARLIN: Okay.

19 JUDGE WARDWELL: Turning to --

20 MR. ROWLEY: Somewhere in that time frame
21 of '06.

22 JUDGE WARDWELL: -- NEC's Exhibit UW-09.
23 It was in -- It took me awhile to get it. It was in
24 Volume I of the four exhibits behind several JH
25 exhibits, NEC JH.

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1 (Off the record discussion.)

2 MR. ROWLEY: NEC UW-09?

3 JUDGE WARDWELL: Zero-nine. It's in
4 Volume I yellow -- And, Entergy, as soon as you are
5 there, can you let me know?

6 MR. FITZPATRICK: Yes sir.

7 JUDGE WARDWELL: Do you have it? I'll
8 give you a few more minutes because I see people even
9 with computer searching some hard paper. I don't
10 understand.

11 (Laughter.)

12 JUDGE WARDWELL: What are we looking at
13 here in this document that's been submitted by NEC of
14 yours?

15 MR. FITZPATRICK: Quality assurance side
16 of the programs in 2004.

17 JUDGE WARDWELL: And this is an Entergy
18 document. Correct?

19 MR. FITZPATRICK: Yes.

20 JUDGE WARDWELL: And is this your audit or
21 is it the Staff's audit?

22 MR. FITZPATRICK: That's the internal
23 Entergy audit.

24 JUDGE WARDWELL: Turning to page two,
25 there's a table in the middle of page two with the top

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1 column headings of Elements, Results and No. Of CRs
2 AFIs. The third element down is flow accelerated
3 corrosion program and under the Result category it
4 says "Unsatisfactory."

5 MR. FITZPATRICK: Yes.

6 JUDGE WARDWELL: What bells did that ring
7 in Entergy's engineering staff and what actions were
8 taken as a result of what appears to be a very
9 discouraging result?

10 MR. FITZPATRICK: The two CRs were written
11 --

12 JUDGE KARLIN: CR?

13 MR. FITZPATRICK: Yes, the condition
14 reports that's part of the corrective action process.
15 The two CRs were written, the first one was written on
16 not getting inspection data into the data management
17 system on time. We had data in fireproof cabinets and
18 we didn't get it within some time limit within the
19 record management system.

20 JUDGE WARDWELL: And so there are really
21 two steps when you have the data. You first have to
22 get it into your old spreadsheets if you will.

23 MR. FITZPATRICK: Yes.

24 JUDGE WARDWELL: And then you have to get
25 it into the program.

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1 MR. FITZPATRICK: Yes.

2 JUDGE WARDWELL: And you didn't even get
3 it into your spreadsheets.

4 MR. FITZPATRICK: No.

5 JUDGE WARDWELL: In a timely fashion.

6 JUDGE KARLIN: Yes or no?

7 MR. FITZPATRICK: I -- No.

8 JUDGE KARLIN: No.

9 JUDGE WARDWELL: Yes, we have no bananas
10 or --

11 (Laughter.)

12 Did you or did you not get it into the
13 spreadsheet program in a timely fashion?

14 MR. FITZPATRICK: Yes, we had it in our
15 programs in there.

16 JUDGE WARDWELL: All right.

17 MR. FITZPATRICK: We had the data
18 evaluated.

19 JUDGE WARDWELL: Yes.

20 MR. FITZPATRICK: The evaluation reports
21 and all the data, the raw data sheets and everything,
22 that go up to that report weren't microfilmed at that
23 point in time.

24 JUDGE WARDWELL: So you had no backup.

25 MR. FITZPATRICK: It was -- prior to the -

1 - But it wasn't in -- says you have to get this out on
2 the next R&B and the second CR was we had the draft of
3 -- had an issue with the report to the outage,
4 previous outage, and it was in draft form at that
5 point in time we wrote a CR on that -- set of acting
6 immediately to get the data in the rims and issue the
7 report.

8 JUDGE WARDWELL: Mr. Witte.

9 MR. WITTE: Yes, sir.

10 JUDGE WARDWELL: Sir, you submitted this.
11 Did the response from Entergy seem to allay your
12 concerns in regards to addressing this unsatisfactory
13 result?

14 MR. WITTE: No, sir. It did not. If we
15 follow the discussion one step further, the
16 implications are that the data from that inspection
17 was not properly incorporated in a reasonable period
18 of time such that the Licensee can prepare for the
19 next inspection and do the next task with CHECWORKS
20 to identify those wear points that should be looked at
21 in the next inspection. This report done by Entergy's
22 own staff brought to light a number of issues. The
23 CRs are just two of them. So I agree with the first
24 one, but I don't agree with the second one.

25 JUDGE WARDWELL: And how would you respond

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1 to that, Mr. Fitzpatrick? Guilty as charged?

2 MR. FITZPATRICK: Guilty of what I said we
3 did and we didn't finish the draft report and
4 inspection still for the next outage would be based on
5 the draft. The CHECWORKS model at that time was not
6 being updated based on the conservative wear rates and
7 the inspection data we'd taken -- They were assuring
8 no wear in the existing inspection data and at that
9 time I had gotten to the point of updating the
10 CHECWORKS model at that point.

11 JUDGE KARLIN: If I can jump in. Is there
12 any minimum requirement specified somewhere as to
13 when, how often, you have to update it?

14 MR. FITZPATRICK: It's recommended that --
15 The new NSAC may have a time limit on it, but it's a
16 resource issue.

17 JUDGE KARLIN: So it's a resource issue.

18 MR. FITZPATRICK: Yes.

19 JUDGE KARLIN: There's no -- There is no
20 minimum amount of time and it says you must update
21 CHECWORKS after X amount of time. Correct?

22 MR. FITZPATRICK: Not in the new
23 procedure.

24 JUDGE KARLIN: Are there any minimum
25 number of cycles or refueling outages?

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1 MR. FITZPATRICK: It's recommended to do
2 it after each outage.

3 JUDGE KARLIN: But what you actually do is
4 a function of what your resources are.

5 MR. FITZPATRICK: What I did at the time,
6 yes.

7 JUDGE KARLIN: So what is the actual
8 amount of time that usually -- Is it once -- What's
9 the longest amount of time you've gone without
10 updating CHECWORKS with the data?

11 JUDGE WARDWELL: Or going with a draft
12 document because all those reasons --

13 JUDGE KARLIN: Yes, over the history of
14 this.

15 MR. FITZPATRICK: Over the history, I
16 think it's three years in 2002 to 2005.

17 JUDGE KARLIN: All right.

18 MR. FITZPATRICK: Or 2003 to 2006. It's
19 like a two cycle period.

20 JUDGE KARLIN: So it was three years was
21 the longest time you went without updating the
22 CHECWORKS.

23 MR. FITZPATRICK: Yes.

24 JUDGE KARLIN: And this normal time, can
25 you give us a normal time that you --

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1 MR. FITZPATRICK: You should do -- I would
2 do it if I had -- I would start after the outage while
3 everything was fresh and get it done. But --

4 JUDGE KARLIN: I'm not saying what you
5 should do. I'm saying what do you actually do.
6 What's your actual normal average time?

7 MR. FITZPATRICK: I would say maybe it's
8 been right after the other, 2006, 2007. All the data
9 is in there now coming into 2008 to the end.

10 JUDGE KARLIN: And this proceeding was
11 pending during that time frame and the license
12 application was pending.

13 MR. FITZPATRICK: Okay..

14 JUDGE WARDWELL: Couldn't one extrapolate
15 this piece of information to say that, in fact, you
16 haven't met the requirements of NSAC 2.1 saying that
17 you have the corporate financial resources necessary
18 to implement the aging management program?

19 MR. FITZPATRICK: We could extrapolate
20 that, but it presents it into the corrective action
21 process and that's why CRs are written to identify
22 these issues.

23 JUDGE KARLIN: Can I? This is for the
24 Staff. Does the Staff think that it ought to be
25 specified a minimum amount of time before they enter

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1 the data into CHECWORKS?

2 MR. ROWLEY: That would be something that
3 the operating or current operating team would have to
4 make that determination. We in license renewal
5 wouldn't.

6 JUDGE KARLIN: You're making a license
7 renewal determination.

8 MR. ROWLEY: Based on the adequacy of that
9 program.

10 JUDGE KARLIN: Adequacy of the program and
11 the program is silent as to whether the data needs to
12 be entered. Is that right?

13 MR. ROWLEY: Well, it's the time it would
14 take to enter. But -- you have to assume they have
15 the data in.

16 JUDGE KARLIN: So let's assume that you
17 approve this. You found it adequate and Mr.
18 Fitzpatrick decided to resource matters he wasn't
19 going to enter that data in for ten years. Now could
20 you come in and say to Mr. Fitzpatrick, "Look here.
21 You're not following what we required you to do."
22 Could you enforce that? Object to that?

23 MR. ROWLEY: I don't know that our
24 enforcement regulations well enough to answer that
25 question.

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1 JUDGE KARLIN: If you have a permit
2 condition that's prescribed, you have to do it every
3 outage.

4 MR. ROWLEY: Or if something comes up.

5 JUDGE KARLIN: Then if they didn't do it
6 every outage you could enforce that.

7 MR. ROWLEY: Right.

8 JUDGE KARLIN: Now if you don't have the
9 provision there that says you have to do it every
10 outage, then you can't enforce that, can you?

11 MR. ROWLEY: They are breaking their
12 current licensing basis we would have a lot of
13 consider.

14 JUDGE KARLIN: Their current licensing
15 basis doesn't say how frequently they had to do it.

16 MR. ROWLEY: Right.

17 JUDGE KARLIN: So they are not breaking --
18 So they could wait for ten years.

19 JUDGE WARDWELL: Moving on, Entergy, what
20 is your response to an updated CHECWORKS result that
21 indicates that failure of the pipe is eminent within
22 the next two refueling cycles?

23 MR. FITZPATRICK: We'd schedule for
24 inspection for the next outage.

25 JUDGE WARDWELL: Waterman said it was

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1 going to before the next refueling outage?

2 MR. FITZPATRICK: As an engineer, I would
3 look to what went into that prediction.

4 JUDGE WARDWELL: And nothing seems -- Or
5 all seems correct and as far as you know that's real
6 information and as good a prediction rate as possibly
7 could be done. Do you have a hierarchy of corrective
8 actions that you would take based on how soon the
9 predicted wear rate, WR, would reach the critical
10 level?

11 MR. FITZPATRICK: There is,
12 programmatically there is a procedure that's based on
13 wear rates at times -- CHECWORKS, for example, one of
14 the components, if you have two parallel trains, I
15 have inspection data on a sister component here and I
16 have inspection data on the component here and here
17 and they show there is no wear and CHECWORKS is still
18 indicating for the identical conditions that there is
19 still very large wear rate and the actual inspection
20 data exacted for this one shows very small wear rates,
21 I'd make a judgment on the results and say, "Okay. We
22 should inspect it or I can defer it."

23 JUDGE WARDWELL: What if they both showed
24 it?

25 MR. FITZPATRICK: Inspect them.

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1 JUDGE WARDWELL: But you can't inspect it
2 until the outage. What if it's predicted that's going
3 to reach a critical level before?

4 MR. FITZPATRICK: At this point in time,
5 we have 12 or 13 outings of data here and it's all
6 factored into the model.

7 JUDGE WARDWELL: Yes. And then all of a
8 sudden because of a measurement and the fact that you
9 were tardy in updating this so you didn't recognize it
10 for awhile and all of a sudden you updated the
11 information and it shows it's going to reach its
12 critical level prior to next refueling outage. Is
13 there any procedure set aside to address that
14 situation?

15 MR. FITZPATRICK: Yes. The corrective
16 action program we did for that.

17 JUDGE WARDWELL: And what would you do?

18 MR. FITZPATRICK: If we believe the
19 results, we would have the corrective action program
20 and if it needed reinspection at the next outage or we
21 would work out a plan to address it either by going
22 down power and inspecting it if it was a real result.

23 JUDGE WARDWELL: Is that spelled out in so
24 many words somewhere?

25 MR. FITZPATRICK: CHECWORKS --

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1 JUDGE WARDWELL: Somewhere. I don't even
2 care if it's -- I know it's not in the aging
3 management plan. But is that spelled out in your FAC
4 or any other document that FAC refers to?

5 MR. FITZPATRICK: Explicitly, no.
6 However, real data, measured data, when it indicates
7 there is a problem with the design basis, that's
8 programmatic with repair and inspect of complaints and
9 we make decisions on real inspection data.

10 We use the CHECWORKS as a planning tool.
11 It's not a safety program. It's used for tracking and
12 tracking and trending and we have data in there. We
13 have enough data on these to make sound engineering
14 judgments. So we should inspect the problem.

15 JUDGE KARLIN: Question. This may be for
16 Dr. Horowitz. Well, first, let me stay with Mr.
17 Fitzpatrick. I think I hear you saying CHECWORKS is
18 there to make predictions as to flow accelerate
19 corrosion. Right?

20 MR. FITZPATRICK: Yes.

21 JUDGE KARLIN: And then you go out and
22 take measurements of flow accelerated corrosion or
23 actual data. Right?

24 MR. FITZPATRICK: Yes.

25 JUDGE KARLIN: And sometimes the

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1 predictions are correct. Is this right?

2 MR. FITZPATRICK: Generally, for us,
3 they've been over conservative.

4 JUDGE KARLIN: And sometimes they are not
5 correct. The data is -- They show more corrosion than
6 CHECWORKS predicted or less corrosion than CHECWORKS
7 predicted.

8 MR. FITZPATRICK: All the inspection data
9 has been showing less wear than CHECWORKS predicts.

10 JUDGE KARLIN: Well, right now, I'm not
11 focusing on whether it's less or more. I'm trying to
12 focus on whether the predictions are always exactly
13 correct and whether there's error in one way or the
14 other. So sometimes the data is different than what
15 CHECWORKS would have predicted. Right?

16 MR. FITZPATRICK: Yes.

17 JUDGE KARLIN: This then is for Dr.
18 Horowitz perhaps. Has there ever been any independent
19 study or analysis of the error rate of CHECWORKS? I
20 mean, obviously you're not independent because you're
21 the vendor of that program? Any third party
22 independent study?

23 DR. HOROWITZ: No.

24 JUDGE KARLIN: Dr. Hopenfeld, do you agree
25 with that that there's been no independent study of

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1 the accuracy?

2 DR. HOPENFELD: Not that I know of and I
3 believe it's against the nuclear regulations. It's
4 not an explicit regulation. It's definitely a part of
5 the -- It's the usual NRC procedure to verify codes
6 through various means and one is from the peer review.

7 JUDGE KARLIN: All right.

8 DR. HOPENFELD: Independent study review -
9 -

10 JUDGE KARLIN: NRC and Mr. Rowley or Mr.
11 Hsu, is it normally NRC's procedure to have it
12 verified as Dr. Hopenfeld just said?

13 MR. HSU: If this is a real precise
14 calculation, then you need to have that. But this one
15 is for the assessment. They are just based on those
16 ready to do the ranking susceptibility, just like a
17 very easy concept. Everybody knows in the -- if
18 you're going to have a higher susceptibility than the
19 piping itself. So this is like a assessment tool
20 doing the ranking and as far as the trending power,
21 that's just like a pretty easy algorithm. This is
22 this inspection. This is next inspection. This is --

23 JUDGE KARLIN: But the question is is it
24 normally NRC normally required for nuclear type of
25 codes like this to have some verification study done?

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1 I don't know. Is it? Or is this the type that you're
2 saying, no, it's not?

3 MR. HSU: I'm not quite sure, but I think
4 CHECWORKS did not really have the verification to the
5 NRC because all those data --

6 JUDGE KARLIN: Those what? All those
7 data, okay.

8 MR. HSU: Yes. The database which is
9 coming from the laboratory which is coming from all
10 the plants, everything. We do not have that
11 accessibility and --

12 JUDGE KARLIN: You don't have what?

13 JUDGE WARDWELL: Accessibility.

14 MR. HSU: Yes.

15 JUDGE KARLIN: Why not?

16 MR. HSU: That's all proprietary
17 information.

18 JUDGE KARLIN: You're the regulator. You
19 can get that information.

20 MR. HSU: Yes, we know we can get that
21 information.

22 JUDGE KARLIN: You have access.
23 Accessibility is not an issue.

24 MR. HSU: Yes, it's not an issue for the -
25 - This program was endorsed by the NRC to resolve all

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1 these because it's for the assessment purpose. Then
2 from the NRC's point of view, this assessment purpose
3 and also it's initiated by the EPRI and also all the -
4 -

5 JUDGE KARLIN: Initiated by EPRI. Now
6 EPRI is a nuclear industry group of companies. Right?

7 MR. HSU: All the utilities.

8 JUDGE KARLIN: All the utilities.

9 MR. HSU: Yes.

10 JUDGE KARLIN: Okay. So these are the
11 regulated -- This is a study by the regulated
12 entities, the ones you're regulating. I'll withdraw
13 the question.

14 Dr. Horowitz, I guess the response you
15 might say is, and Mr. Fitzpatrick is indicating, if
16 the errors are all on the conservative side so it were
17 okay. Is that kind of the response?

18 DR. HOROWITZ: No. In the case of Vermont
19 Yankee, which EPRI looked at the program that is the
20 case, let me address a broader question. EPRI has
21 looked at doing nuclear ratings at the various level.
22 When they asked the member utilities, "You know, if we
23 do nuclear level QA on this program, it's a very
24 expensive item. Do you folks as the users of the
25 program want this step, this level of QA?"

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1 JUDGE KARLIN: So you asked the people
2 that have to spend the money whether they want to
3 spend the money and they say no.

4 DR. HOROWITZ: They say no, yes. But
5 there are going to be hearings like this where they
6 have to answer these questions and they have to deal
7 with the regulators and have to answer these
8 questions.

9 JUDGE KARLIN: Well, the regulators don't
10 seem to have asked that question, but we now have.

11 DR. HOROWITZ: So the answer has come back
12 that the utilities view this program as not used for
13 nuclear design or nuclear applicability but just to
14 provide information to FAC engineers just like Mr.
15 Fitzpatrick and that --

16 JUDGE KARLIN: Okay.

17 DR. HOROWITZ: The information has been
18 filtered and used. So the information produced by
19 CHECWORKS is not directly used for functions typically
20 covered by nuclear level QA.

21 JUDGE KARLIN: Isn't that sort of like the
22 fox is deciding whether we should put a guard on the
23 hen house?

24 DR. HOROWITZ: I don't consider EPRI the
25 either fox or hen.

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1 JUDGE KARLIN: They're regulated entities,
2 the ones who are being regulated by NRC and the NRC is
3 working on behalf of the public.

4 DR. HOROWITZ: Well, the people --

5 JUDGE KARLIN: When I used to work at EPA,
6 would we go and ask the chemical companies whether
7 they wanted to be inspected? It wasn't their vote.
8 It was EPA's vote.

9 DR. HOROWITZ: I certainly understand
10 that, but that's still the -- EPRI is a creature of
11 the utility industry and their members pay the bills
12 such that we don't think it's a reasonable expense of
13 money. EPRI does not have to follow recommendations
14 in this case such that it makes sense.

15 JUDGE KARLIN: It's like the Chemical
16 Manufacturers Association deciding whether some
17 chemical should be regulated by EPA. All right.

18 JUDGE WARDWELL: Dr. Hopenfeld, as I look
19 at your testimony in JH-01, Answer 22, where you were
20 asked to briefly summarize the basis for your
21 assessment the aging management program.

22 DR. HOPENFELD: JH-01?

23 JUDGE WARDWELL: Yes, JH-01 and I'm
24 looking at Answer 22 and really 23 and I'm only
25 looking at it in an engineering sense. I don't really

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1 think you need to see it. That's where the root of
2 this came from. If you can remember your assessment
3 of this program, it seems like you were pretty
4 pessimistic regarding any attempts to predict the flow
5 accelerated corrosion.

6 DR. HOPENFELD: Correct.

7 JUDGE WARDWELL: As I read this, that's my
8 interpretation of it. Given that, what would you
9 suggest ought to be done to detect and predict flow
10 accelerated corrosion in the alternative?

11 DR. HOPENFELD: I believe we should
12 recalibrate --

13 JUDGE WARDWELL: What do you mean by
14 "recalibrate"?

15 DR. HOPENFELD: Re-benchmark --

16 JUDGE WARDWELL: And what do you mean by
17 "re-benchmark"? What's the difference between the
18 two?

19 DR. HOPENFELD: Not much. It's just --
20 Let me just tell you what the benchmarking is and
21 there's a very slight difference and I think the way
22 I see it benchmarking, the reason that we should
23 benchmark, is you take the computer code which you
24 already have and you compare it with plant data and
25 you make adjustments if they are necessary or you

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1 don't make adjustments or you just specify --

2 Now calibration sometimes is usually a
3 tiny little bit different because you start with a set
4 of equations, you know -- or something. You guess as
5 to what the thing would look like and then you start
6 correlating the data. They're almost the same.
7 That's the way I heard it expressed.

8 JUDGE WARDWELL: I'm looking through some
9 future notes here. But it seems like there was
10 another phrase that came up also. Was it one point
11 you said it's not qualifying I think, if my memory
12 serves me correct because I can't put my finger right
13 at the moment? Did you use that phrase at some point
14 in your testimony?

15 DR. HOPENFELD: I don't remember but
16 (Inaudible) question -- I think that definition is
17 somewhere in the NRC analogy. There was also some
18 definition with regards to it.

19 JUDGE WARDWELL: Okay. Can I just put
20 your thoughts just on hold for a second because I want
21 to finish this point?

22 DR. HOPENFELD: Sure.

23 JUDGE WARDWELL: Otherwise, I would have
24 to get back to it later on.

25 Entergy, is there any difference between

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1 benchmarking, calibration and qualification of the
2 CHECWORKS model? Dr. Horowitz.

3 DR. HOROWITZ: To me trying to explain,
4 the word that's normally used in software QA type
5 activities is called validation.

6 JUDGE WARDWELL: So we have another word.
7 That word is on my list, too.

8 DR. HOROWITZ: Normally, in software, you
9 have a process called verification and verification
10 means that the handwritten equations are properly
11 implemented in the program and obviously for
12 complicated things that can be a complicated process.
13 Validation refers to the process of answering the
14 question "Is the program producing the results you
15 want them to produce," in other words, predicting the
16 phenomenon within reasonable error and I think
17 benchmarking or -- What was the other -- I forgot the
18 other term is qualification. That is clearly
19 something different. I think what we're talking about
20 here is validation of the program.

21 JUDGE WARDWELL: But your validation as I
22 had heard your definition of it is merely
23 demonstrating that the computer code that the computer
24 code which has blocks of different lines of program
25 coding in it. Does it in fact solve the calculations

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1 you want it to solve?

2 DR. HOROWITZ: No. It shouldn't. That's
3 verification.

4 JUDGE WARDWELL: That's what I said. Your
5 verification is --

6 DR. HOROWITZ: Verification. I'm sorry.

7 JUDGE WARDWELL: Just does this program
8 solve equations we want?

9 DR. HOROWITZ: Right.

10 JUDGE WARDWELL: Benchmarking would be
11 something different, wouldn't it, in regards to --
12 Isn't there a need also to take the program and say,
13 "Now is it able to accurately model the real life
14 situation that we're trying to use the darn thing for
15 and you would apply it to simplistic cases where you
16 know exact solutions or something like that to say,
17 'Yes, we are able to also model the physical
18 phenomenon that we're interested in'?"

19 DR. HOROWITZ: I'm sorry I didn't make
20 myself clear. That process is called is validation.

21 JUDGE WARDWELL: Both those things.

22 DR. HOROWITZ: No. Verification and
23 validation.

24 JUDGE WARDWELL: I'm sorry. Maybe I got
25 confused. Yes, I may. Two Vs, okay.

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1 DR. HOROWITZ: Right.

2 JUDGE WARDWELL: Sorry. So verification
3 the model does the calculations. Validation the model
4 knows the -- represents true physical phenomenon.

5 DR. HOROWITZ: Exactly.

6 JUDGE WARDWELL: And you would use the
7 word benchmarking or which would benchmark. You would
8 be the closer to the validation.

9 DR. HOROWITZ: Probably.

10 JUDGE WARDWELL: And what about
11 qualification? You don't know.

12 DR. HOROWITZ: No answer.

13 JUDGE WARDWELL: NRC, do you have any
14 specific definitions that the staff uses in this
15 regard?

16 MR. HSU: Benchmark means you want to try
17 to verify something you can use another --

18 JUDGE WARDWELL: Another what?

19 MR. HSU: Another independent method to
20 validate that is NSAC which is normal and then you
21 have this program which can generate exactly the same
22 answer which is already validated and solution.
23 That's the benchmark.

24 JUDGE WARDWELL: So it's almost a set of
25 your validation. I would put that as a subset where

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1 you have a known result.

2 MR. HSU: yes.

3 JUDGE WARDWELL: A true known physical
4 result.

5 MR. HSU: I true known physical result.

6 JUDGE WARDWELL: And you are able to model
7 it precisely and say, "Yes, we benchmark it to that"
8 and then other validation efforts could take place
9 where we're not -- where we don't have an exact
10 solution or a precise one, but we have an indication
11 of what the physical phenomena is and see how well it
12 does against that because we've observed that for a
13 number of years or something like that.

14 MR. HSU: Right.

15 JUDGE WARDWELL: To see how well it does.
16 I can buy that. Do you have any arguments with those
17 definitions, Dr. Hopenfeld?

18 DR. HOPENFELD: People use them
19 differently.

20 JUDGE WARDWELL: Sure.

21 DR. HOPENFELD: Like, for example, we've
22 discussed talking about the EPU and remember we had
23 codes that were benchmarked against some turbine trip
24 transients and the word was constantly used,
25 benchmark. So it's kind of subjective.

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1 JUDGE WARDWELL: So your benchmarking is
2 pretty much now Mr. Hsu's defining it.

3 DR. HOPENFELD: I have the same problem.
4 Yes, I'm not a psychology expert. But some of these
5 words have different meanings, but a little different
6 equation. When you say you validated it, you are
7 making sure that it's correct.

8 JUDGE WARDWELL: Trust me. If you get on
9 a board like this and work with legal people, they
10 really start pinning us technical people down. We
11 start throwing these words around.

12 DR. HOPENFELD: I'm not legal. I'm not a
13 legal person. Nor am I a psychiatrist.

14 JUDGE WARDWELL: But you want to be both,
15 don't you?

16 DR. HOPENFELD: No, I do not.

17 JUDGE WARDWELL: Okay. I'm just checking.

18 (Laughter.)

19 DR. HOPENFELD: I honestly do not.

20 JUDGE WARDWELL: Thank you.

21 Back to what would you suggest them to do?
22 We're back to the point that you're pretty pessimistic
23 about this ability to predict FAC. You started to
24 talk about benchmark and I interrupted you because I
25 wanted to clarify that definition.

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1 DR. HOPENFELD: Yes.

2 JUDGE WARDWELL: And now I'm interested in
3 what would you suggest. - Fine. You criticize it all.
4 But what else could they do?

5 DR. HOPENFELD: Well, first of all --

6 JUDGE WARDWELL: Let me break it down.

7 DR. HOPENFELD: Yes. I think I can answer
8 if you break it down.

9 JUDGE WARDWELL: I'll break it down a bit.

10 DR. HOPENFELD: Yes.

11 JUDGE WARDWELL: Let's start with the
12 bigger picture and then I think you'll probably get
13 into the smaller picture. So I'm interested in the
14 bigger picture. What could they do completely
15 different? Let's not even in your first answer try to
16 start getting any critiquing CHECWORKS and proving
17 that or improving how that output is done or inputted.
18 Is there any other bigger thing that they could do
19 drastically different that would really improve their
20 FAC program that's really innovative that people
21 haven't thought about and yet is very practical to do?

22 DR. HOPENFELD: Very innovative. I think
23 their basic approach that they had started 20 years
24 ago, the concept, could have been -- it was okay.
25 However, I think it was done by several people without

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1 having an opportunity from the outside. Those are --

2 JUDGE WARDWELL: But is there anything
3 outside of the CHECWORKS community that now exists,
4 granted maybe something could have done better back
5 there, but now is there anything big that you people
6 have really just kind of overlooked? I don't mean
7 innovative. I said that but I didn't mean it. That
8 people have overlooked that you're aware of that "Gee,
9 why don't we just do this? Gee I hadn't thought of
10 that. That might be a good idea." Do you know of
11 anything out there?

12 DR. HOPENFELD: I'll give you one example.
13 Okay. Prior to CHECWORKS and all of that, industry
14 had a lot of problems with corrosion or --

15 JUDGE WARDWELL: Yes. We're on the watch
16 now.

17 DR. HOPENFELD: Okay. One is each plant
18 had an expert that would be working on, completely
19 dedicated, all his life has been working on this and
20 knows every file and every place in that system and is
21 well communicated with other systems, not necessarily
22 new systems. That would be one way from eliminating
23 any computer codes because therefore we would be doing
24 it for hundreds of years.

25 There are some instrumentation we can do.

1 But we're getting into a different subject. It's
2 difficult to do certain instrumentation reports.
3 There's no reason for it. In other words, we could in
4 the chemistry effect and corrosion and some part of
5 system we could -- not necessarily the mainstream but
6 you could run side -- and find out. There are things
7 you can do -- given the safety --

8 (Off the record comment.)

9 JUDGE WARDWELL: Dr. -- I would like to
10 interrupt you because I want to hear more of this and
11 I really think we want to take a break and I don't
12 want to cut you short. So I'll get back to this and
13 I know Dr. Hausler may have had some comments and I'd
14 rather not try to push it. I was trying to squeeze
15 this all in and I got off on the benchmarking and I'd
16 rather just pick it up right after lunch and we'll get
17 right back to that point.

18 JUDGE KARLIN: All right. With that, we
19 will stand adjourned until 1:15 p.m. Off the record.

20 (Whereupon, at 12:01 p.m., the above-
21 entitled matter recessed and reconvened at 1:15 p.m.
22 the same day.)

23 JUDGE KARLIN: Please be seated. The
24 Board will now continue. Back on the record, Mr.
25 Reporter. The Board will now continue with the

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1 questioning of expert witnesses on Contention Four.
2 I will again remind the witnesses that you are under
3 oath, so you recognize that, I'm sure. And with that,
4 Dr. Wardwell, I think has -

5 JUDGE WARDWELL: Dr. Hopenfeld, I think
6 where we left off at lunch break, you were describing
7 potential other techniques or modifications to the
8 existing techniques that could be used in a flow
9 accelerated corrosion program.

10 DR. HOPENFELD: I was general. However,
11 that's the following I would have. And that, as we
12 discussed the other day, we started with a new plan,
13 basically a new plan. And I think we ought to start
14 with new data evidence. As we go along gathering the
15 database -

16 JUDGE WARDWELL: And what would be added
17 to the existing database, do you suggest?

18 DR. HOPENFELD: I have recommended -- I
19 provided the initiative which indicates how to collect
20 that data.

21 JUDGE WARDWELL: Okay. Thank you.

22 DR. HOPENFELD: There's a table, I can
23 give you the table on it, if you will.

24 JUDGE WARDWELL: Yes, just reference the
25 table number. You don't have to read it. Just so I

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1 can refer to it once I read the transcript.

2 DR. HOPENFELD: Give the table to you. I
3 don't think you're going to find the table, but it's
4 at end of the initial position, which I think is the
5 last page.

6 JUDGE WARDWELL: In the Statement of
7 Position?

8 DR. HOPENFELD: Yes.

9 MS. TYLER: May I provide a reference?

10 JUDGE KARLIN: Yes, please.

11 MS. TYLER: It's JH-36 at 15.

12 JUDGE KARLIN: JH-36 at 15.

13 MS. TYLER: Yes.

14 JUDGE KARLIN: All right. Thank you.

15 DR. HOPENFELD: JH-36, page?

16 JUDGE KARLIN: 15. We've got it, Dr.
17 Hopenfeld.

18 DR. HOPENFELD: You got it?

19 JUDGE KARLIN: Yes. No, we don't need to
20 refer to it. We know that it's there. We'll look at
21 it later.

22 DR. HOPENFELD: And you see there's one --
23 there are two aspects to this. One, it has a much
24 denser grid compared to what we've got now. And the
25 reason for that is to get away from all the

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1 uncertainties, and I would say very arbitrary
2 equations that were -- and which checkpoint the
3 status. Now we go further in corrective ways to
4 advance. This would get away from the issue of
5 discontinuities, the issue of local turbulence
6 covering the whole area. I ran a lot of incentive
7 checks on this side of the field, and this probably
8 doesn't say how many, around how many components we
9 are -- it's divided into A, B, C, D, and divided into
10 only three -- the width.

11 The first thing you do, you select what
12 you're going to include in this group. You're not
13 classifying what is the larger. The smaller they are,
14 the pipes, you're going to see how risk-significant
15 those parameters are. If you wish me to give you
16 criterion for that, which I haven't heard these
17 gentlemen even mention it. One which I used to do all
18 the time was CDF. That's one criteria that you would
19 use to say if I have this, you could be very, very
20 well -- this is very valuable, and you may not even
21 detect it, but suddenly you have a water hammer
22 somewhere and a systemic rupture. So that concept
23 that was proposed to you, we have this concept of leak
24 before break, it has not been yet accepted by the NRC,
25 to the best of my knowledge.

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1 JUDGE REED: Could we stop there and ask
2 the NRC whether they would concur with what you're
3 saying?

4 DR. HAUSLER: I'm sorry. I didn't hear
5 the question.

6 JUDGE REED: He said leak before break.

7 JUDGE KARLIN: It's a question for NRC.

8 JUDGE REED: Yes. The question is
9 directed to the NRC.

10 MR. HSU: Leak before break actually we
11 should apply to that -

12 JUDGE REED: We can't hear you.

13 MR. HSU: Leak before break is applied to
14 the cracking, and which is not applied to the FAC.
15 FAC is talking about a big area material loose. Leak
16 before break is talking about cracking, very small
17 cracking, gradually expanding. It's different aging
18 mechanism.

19 JUDGE REED: What about erosion type of -

20 MR. HSU: Erosion type, which is not
21 considered -

22 JUDGE REED: Is leak before break
23 appropriate there?

24 MR. HSU: Leak before break is not
25 appropriate in there.

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1 JUDGE REED: Not appropriate for any kind
2 of corrosive thinning. Is that what you're saying?

3 MR. HSU: Because corrosive thinning,
4 which is you're going to loose a big area. And leak
5 before break, which only allow you like a one GPM, you
6 lost one GPM, that range, so which is very small
7 opening.

8 JUDGE REED: Well, let me ask Entergy.
9 Dr. Horowitz, what's your position? My understanding
10 was that it was -- what we've been calling flow
11 accelerated corrosion, that occurs over large areas,
12 and produces a sudden rupture of the pipe. But if you
13 have other corrosive phenomena, you might get very
14 small pinhole leaks. Am I wrong?

15 DR. HOROWITZ: No, that's correct. With
16 FAC, as use the term, the damage is widespread, and
17 the leaks are the extent -- you're up to sudden
18 catastrophic, such as Surry. Behavior such as erosion
19 is kind of -- to me, you could apply leak before break
20 because you don't want to just get small jets, small
21 pinhole-type leaks, but it's not exactly the same as
22 cracking where you're estimating that the crack is
23 going to grow, the leak is going to increase with the
24 -- particularly with impingement kind of failures, you
25 just get a hole just to blowout that hole pretty much

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1 forever. The hole is not going to enlarge a great
2 deal.

3 JUDGE REED: Okay. I'm sorry for the
4 interruption.

5 DR. HOPENFELD: It's classified as A, B,
6 C, D, and you classify those in terms of safety-
7 significance. By doing that, you have eliminated a
8 large number of components that you don't have to do
9 it -- but you have to do it quantitatively. We
10 haven't seen -- I don't believe you have seen any
11 quantitative indications. We have heard statements,
12 well, this is not safety-related, safety-related. I
13 don't know. There's a number for that. When the NRC
14 does a generic safety evaluation, cost benefit
15 studies, the numbers they come in, the criteria, the
16 CDF. And the CDF is an indicator. We've indicated
17 that it indicates that this protects the public. When
18 there's criteria with CDF, that takes the effective
19 nine to five away. So that's what you have to do.
20 And you have a criteria -

21 JUDGE REED: Pardon me. Could you define
22 CDF?

23 DR. HOPENFELD: CDF is Core Damage
24 Frequency. What kind of accident -- so you do that.
25 You have narrowed down the total numbers of components

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1 on a logical defensive basis. The next thing you do,
2 you take a computer code, and I'd be very happy to
3 have CHECWORCS, as well. You already have the
4 mathematics of storing data, all you have to do is
5 modify. How are you going to modify? Some of the
6 equations there are just way -- they're way off. They
7 don't have to do with experiment, they don't have to
8 do with anything else. To show you that, it is so
9 obvious. I would have to go further into that, if you
10 allow me.

11 JUDGE WARDWELL: And you'll provide that
12 in the testimony?

13 DR. HOPENFELD: Some. There's not new
14 information. We need all the information is in the
15 testimony, but I did some background calculations
16 further yet. Do you want me to provide it?

17 JUDGE REED: You've alleged several times
18 that there are incorrect equations in the CHECWORKS,
19 so I think we have to stop and ask you to at least
20 identify one or two.

21 DR. HOPENFELD: Oh, okay.

22 JUDGE REED: I don't want a long lengthy
23 discourse -

24 JUDGE WARDWELL: Just say what they are.

25 JUDGE REED: Just say what they are.

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1 JUDGE WARDWELL: Which ones?

2 DR. HOPENFELD: Okay, the one that is of
3 most concern is the whole develop -- the relationship
4 between corrosion and velocity is based on data, and
5 I believe I gave you it in the write-up, of the copper
6 dissolution in hydrochloric acid. We do not have
7 cooling in that reactor with hydrochloric acid. Most
8 of the material is not copper.

9 JUDGE WARDWELL: Okay. What's the next
10 one?

11 DR. HOPENFELD: Okay. The next one, there
12 is an equation in one of the graphs that relates the
13 local corrosion rate to the total -- to the average
14 corrosion rate in a fitting, a pipe, an elbow,
15 whatever. There's a typographical error, I believe,
16 there, because it said $A=A+A$ times D. Okay? I gave
17 you that equation. You say equal A, equal A, you see
18 also -- there must be some error with EPRI there.
19 There must be some typo. But if you forget about the
20 typo, if you look at the numbers of B -

21 JUDGE REED: I'm sorry. Are you alleging
22 that EPRI made a typo, or you made a typo?

23 DR. HOPENFELD: No, I didn't make the
24 typo. I just took their equation from the documents
25 they provided us.

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1 JUDGE REED: Okay.

2 DR. HOPENFELD: I just copied -- I don't
3 remember which document it was. I think it's the one
4 with the two or three guidance, the guidance up to the
5 CHECWORCS. What they do, the concept that they use is
6 incorrect, too. They're using an average value, which
7 is represented in a way by -

8 JUDGE WARDWELL: An average value of what?

9 DR. HOPENFELD: Average value for a given
10 consideration. You have a different, a valve to have
11 a different A.

12 JUDGE WARDWELL: Is this a geometric
13 factor? Which factor of those factors that were
14 presented in regards to CHECWORKS does this apply to
15 that you're talking about?

16 DR. HOPENFELD: There was a table shown
17 that - and I can give you the reference - the table
18 with all the fittings, it's used engineering. You can
19 look it up in any handbook. It's being used to
20 calculate pressure drops of a fitting, and that's
21 what we used. But what's missing here, this is an
22 average value. It's not -- what's you're really
23 interested is in the local value, not the average. So
24 he has a correction in there, and his correction is
25 Factor B that came from one specific experiment, from

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1 one specific geometry. If you take that correction,
2 then compare it to real life data, so you see that
3 that would be by order of magnitude, they would be off
4 by an order of magnitude. And the particular -

5 JUDGE WARDWELL: What's your next one?

6 DR. HOPENFELD: I'm sorry. Okay. The
7 next one in CHECWORKS, I would say the inability to
8 relate the computer code, too, unless I'm repeating
9 myself. The inability to calculate local corrosion
10 rate. They have testified that local, instead of kind
11 of -

12 JUDGE WARDWELL: What's your next one?

13 DR. HOPENFELD: Well -

14 JUDGE WARDWELL: Is that it?

15 DR. HOPENFELD: No, I just have -- I think
16 there's just one more. I was interrupted, but these
17 were the two major ones. The inability to calculate
18 the local thing, the inability to -- oh, here's the
19 major one. If you look at the correlation for --
20 every now and then it gets specific. If you look at
21 the correlation for VY -

22 JUDGE WARDWELL: That's velocity.

23 DR. HOPENFELD: I'm sorry?

24 JUDGE WARDWELL: VY is velocity?

25 DR. HOPENFELD: Vermont Yankee, no.

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1 JUDGE WARDWELL: Oh, oh, Vermont Yankee.

2 DR. HOPENFELD: Look at the correlation of
3 the prediction, when we talk about predictions, and
4 they give you three lines. If you take those three
5 lines away, and I ran a test. I took those three
6 lines away and I asked five people, a couple of them
7 were engineers, three of them, I don't know, they were
8 not -- I don't know, psychology maybe. And I ask them
9 take a look at this. What's the best line to run over
10 this data? Know what they said? Straight line. What
11 straight line means? No correlation. The code
12 doesn't predict anything.

13 JUDGE WARDWELL: And what graph or data
14 are you using that you're -

15 DR. HOPENFELD: Yes. I would like -- Dr.
16 Hausler to look into this much deeper than I did, but
17 let me give you the draft first. The one I'm talking
18 about, I have two. One is E-4-30 at 39.

19 JUDGE WARDWELL: Okay.

20 DR. HOPENFELD: The other one, E-4-29 at
21 10. I have another one, and that is NEC JH-37 at Figure
22 5.

23 JUDGE WARDWELL: Say that again, now.

24 DR. HOPENFELD: JH-37 at Figure 5.

25 JUDGE WARDWELL: Okay. Thank you. Is

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1 that all your main issues?

2 DR. HOPENFELD: Yes.

3 JUDGE WARDWELL: You said you had three,
4 and those are three.

5 DR. HOPENFELD: Yes, I was going to tell
6 you why, though.

7 JUDGE WARDWELL: No, no. I've got the
8 why. I think I understand.

9 DR. HOPENFELD: Okay. One thing that
10 hasn't been brought up, if I may, on the -- and that
11 goes to some degree to the definitions. If you look
12 at that Figure 5 that I gave you, the NRC position was
13 from that figure that there's no time effect
14 whatsoever on corrosion. In other words, once you
15 measure the corrosion rate in the morning, it's to be
16 there forever like that. If you look at this figure,
17 there is nothing in the universe that talks about
18 corrosion rate here. However, they concluded from
19 that figure that there is no effect of time -

20 JUDGE WARDWELL: What figure, sir?

21 DR. HOPENFELD: It's Figure 5 in JH-37.

22 JUDGE WARDWELL: Okay. Thank you.
23 Entergy, Dr. Horowitz, would you like to respond to
24 those particular aspects?

25 DR. HOROWITZ: Okay. Let me get things

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1 clear. The first issue was how FAC varies with
2 velocity. The second was the AV figures on Figure 7-
3 2. The third was copper modeling and -- I think it's
4 copper modeling and geometry factors. And the fourth
5 has to do with predictions.

6 JUDGE WARDWELL: I have them written a
7 little bit different, but proceed ahead.

8 DR. HOROWITZ: Okay.

9 JUDGE WARDWELL: I thought there was a
10 wear versus flow relationship that was derived from
11 copper tests.

12 DR. HOROWITZ: I think that's really the
13 first one.

14 JUDGE WARDWELL: Okay.

15 DR. HOROWITZ: Let me speak to it. I
16 can't be very brisk because some of these are long,
17 intricate answers.

18 JUDGE WARDWELL: Try to make them short
19 and simplistic answers.

20 DR. HOROWITZ: First of all, let's talk
21 about the variation of velocity with -- flow-
22 accelerated corrosion rate with velocity. And Dr.
23 Hopenfeld cites work done in England by Geoff Bignold,
24 et al, and Ian Woolsey, et al. And it's interesting
25 that my first involvement in FAC was right after the

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1 Surry accident. Bindy Jackzo was putting -- was on
2 the team putting together an EPRI White Paper, and
3 Bindy prepared an assessment of what a post accident
4 prediction would use using best available technology.
5 And he selected that exact technology, and he put
6 together the appendix, he asked me to check what he
7 had done, and to computerize what he had done. He
8 also asked me to look at -- he had assembled, as I
9 said yesterday, laboratory data from England and
10 France.

11 JUDGE WARDWELL: I'd like to cut you
12 short.

13 DR. HOROWITZ: Okay.

14 JUDGE WARDWELL: Love the reminiscing, but
15 for what we need here is, we need an explanation of
16 why would the wear rates from a copper test be
17 appropriately applied to what is indicated to be the
18 relationship that's used here for that relationship as
19 it relates to flow, not how it was -- just why.

20 DR. HOROWITZ: Fine, but that was three
21 different questions you just asked. Let me finish the
22 first, and I'll get to the other two.

23 I was the first one to look at that
24 English and French data. My bias was towards Woolsey
25 and Bignold, who said velocity was second or third

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1 power. It took me less than a half an hour to
2 convince myself that the velocity dependency was much
3 more than linear. That is based on laboratory data.
4 We have seen the same thing in 20 years with the plant
5 data. If the exponent was any year in the range of
6 2.4 to 6, as Dr. Hopenfeld has said in his testimony,
7 we would have seen that instantly. The program
8 wouldn't have worked, nobody would use it. So that's
9 my comment on velocity.

10 JUDGE WARDWELL: So your opinion is that
11 it is linear because your initial studies of the lab
12 data clearly showed that within a very short period of
13 time of looking at that, and it's been proven to be
14 correct because your model was able to track
15 reasonably well what you're getting in the plants.

16 DR. HOROWITZ: Yes.

17 JUDGE WARDWELL: Thank you.

18 DR. HOROWITZ: One more sentence, and that
19 linear dependency matches the French model, the EDF
20 model, which is generally accepted model for FAC.

21 JUDGE KARLIN: For what? Generally
22 accepted for -

23 JUDGE WARDWELL: FAC.

24 DR. HOROWITZ: For FAC prediction.

25 JUDGE KARLIN: Okay, FAC. I'm sorry.

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1 DR. HOROWITZ: Secondly, the figure that
2 Dr. Hopenfeld was referring to is from the FAC book.

3 JUDGE WARDWELL: Which figure? He
4 referenced several figures. Which one are you
5 referring to?

6 DR. HOROWITZ: The figure -

7 DR. HOPENFELD: D-408.

8 DR. HOROWITZ: A and B Factor.

9 JUDGE WARDWELL: Yes.

10 DR. HOROWITZ: And that is not used in
11 CHECWORKS. In fact, it's not used by EPRI. That is
12 EDF background figure used in their code BRT-CICERO
13 that I mentioned earlier today. So that really has no
14 relevance to CHECWORKS and what we're doing.

15 Third point, copper. The copper tests
16 were not used to establish wear rates. They were not
17 used to define geometry tables. They were just used
18 to give us a fast way of doing tests of various
19 geometries. The paper, one of my exhibits by Drs.
20 Paulson and Robinson talk about the derivation of that
21 method, and how, indeed, it does scale CO corrosion
22 with FAC.

23 In looking at the results of the tests we
24 funded, it turned out that there were differences
25 between copper and steel, but not qualitatively. So

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1 we used the qualitative results, but all the geometry
2 factors in CHECWORKS come from plant data.

3 JUDGE WARDWELL: Okay.

4 DR. HOROWITZ: The last one was Vermont
5 Yankee predictions.

6 JUDGE WARDWELL: The correlations using
7 scattered data shown on the Figures E-4-30 at 79, E-4-
8 29 at 10, and JH-37 at Figure 5.

9 MR. FITZPATRICK: Is E-4-30 at -

10 JUDGE WARDWELL: I have E-40-30 at 79.

11 MR. FITZPATRICK: 79. E-4-30. What is
12 the title? Is that the graph with -

13 JUDGE WARDWELL: I don't know. Dr.
14 Hopenfled, I'm looking at page 79 of E-4-30 and it's
15 a table of data. Are you talking about 78, where it's
16 the comparison of wear prediction, prediction rate
17 versus measured wear?

18 DR. HOPENFELD: No, I wasn't talking about
19 a table, I was talking about the graph. E-4-30 at 79.
20 As a matter of fact, it's also given -

21 JUDGE WARDWELL: But listen to me, E-4-30
22 at 79 is a table.

23 DR. HOPENFELD: If that's the case, then
24 we have another one at JH, which I believe is the same
25 one. I don't know why -

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1 JUDGE WARDWELL: How about -

2 DR. HOPENFELD: It's RH-05, the last --
3 it's Figure 3, and I think it's page 12 of 12.

4 DR. HAUSLER: Page 57 would be a good
5 example.

6 JUDGE WARDWELL: I'm sorry, Dr. Hausler?

7 DR. HAUSLER: There are a number of these
8 graphs in that particular exhibit.

9 JUDGE WARDWELL: And this is RH -

10 DR. HAUSLER: What I'm saying is that page
11 59 might be an excellent example to illustrate what
12 Dr. Hopenfeld wants to study.

13 JUDGE WARDWELL: And this is in RH-05?

14 DR. HAUSLER: This is in Exhibit E-4-30,
15 and it's on page 57.

16 JUDGE WARDWELL: Okay.

17 DR. HAUSLER: It's a handwritten page in
18 there.

19 JUDGE WARDWELL: Yes. How about that, E-
20 4-30 at 57? And there are a number of these graphs in
21 this particular exhibit, of which this is one. And
22 the criticism is that ocularly one could easily say
23 that should be a horizontal line instead of a sloped
24 line, and still probably have as much -- have as good
25 a fit to the data as the slope line you have. If

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1 you'd like to respond to that.

2 DR. HOROWITZ: Okay. First, let's all
3 look at that same figure. And what you're seeing is
4 a large amount of feedwater data. As Mr. Fitzpatrick
5 mentioned this morning, feedwater data at Vermont
6 Yankee is wearing very slowly, if at all. If you turn
7 the page -

8 JUDGE WARDWELL: Is what? I'm sorry. I
9 didn't hear that.

10 DR. HOROWITZ: Is wearing very slowly, if
11 at all. I'm sorry.

12 JUDGE WARDWELL: Oh, the feedwater -- all
13 right.

14 DR. HOROWITZ: And that fact is indicated
15 by the line direction factor be so low. If you turn
16 the page, you'll see that the thick -

17 JUDGE KARLIN: Let me stop you. We're
18 referring to page 58 now?

19 DR. HOROWITZ: Yes.

20 JUDGE KARLIN: Thank you.

21 DR. HOROWITZ: E-4-30.

22 JUDGE WARDWELL: 58.

23 DR. HOROWITZ: That's the same data
24 plotted not as difference data, but as thickness data.
25 And you can see that for most points, the thickness of

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1 the pipe was 1200 mils, or 1.2 inches, and so the
2 amount of wear that you're seeing on the previous page
3 is quite small as a percentage of that.

4 The other point I'd like to mention is
5 that we have seen similar behavior for CHECWORKS for
6 BWR feedwater lines in other units. And we are
7 considering efforts to understand what's going on in
8 that area, because this is a particular problem area
9 we know about, as far as the under-prediction of BWR
10 feedwater.

11 JUDGE REED: Could you repeat that? I
12 didn't hear you. As far as the under-protection?

13 DR. HOROWITZ: Under-prediction.

14 JUDGE REED: Under-prediction of -- I just
15 didn't hear you.

16 DR. HOROWITZ: Of corrosion rates. I'm
17 sorry. If you look at the line correction factor, the
18 line correction factor is in the perfect world unity,
19 we like it to be between 0.5 and 2.5. The fact that
20 it's this low indicates that the model was not
21 performing well, and you see the same behavior in
22 other units.

23 JUDGE REED: So this is an indication that
24 the model is not performing well?

25 DR. HOROWITZ: That's correct.

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1 JUDGE REED: For this particular pump -

2 DR. HOROWITZ: This particular line, yes.

3 JUDGE REED: Is this typical of how it
4 performs across the -

5 DR. HOROWITZ: No. As I said, in general,
6 the model performs much better, and it turns out, as
7 luck would have it, except for BWR feedwater line, you
8 can see this problem pretty much across the board.

9 JUDGE WARDWELL: What was the range you'd
10 like the line correction factors to be?

11 DR. HOROWITZ: 0.5 to 2.5.

12 JUDGE WARDWELL: Are you familiar with
13 this particular exhibit? Yes, you provided it, E-4-
14 30. Do you have a table of all the line correction
15 factors so we don't have to leaf through this to see
16 how many there are? I look at page 32 - that's a
17 feedwater line again. I'm just curious to see whether
18 or not, how many of the lines -- do you plot out one
19 of these for each different component?

20 MR. FITZPATRICK: That represents each
21 line, or segment of piping in the plant. For example,
22 from the feedwater pumps to the feedwater heater, that
23 would be one line. The number of piping components,
24 each one of those graphs represents that, so there's
25 50 or 60 components, say, in that line. And they're

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1 all listed -

2 JUDGE WARDWELL: So just for
3 clarification, that's an analysis line. Each one is -

4
5 MR. FITZPATRICK: Yes.

6 JUDGE WARDWELL: So how many plots like
7 this do you have in this exhibit, so I don't have to
8 wade through. Do you know?

9 MR. FITZPATRICK: Almost 10, I think,
10 around 10. There's different sections of feedwater in
11 sections that are -- These are the most susceptible
12 piping at VY.

13 JUDGE WARDWELL: But how many -- what else
14 do you have besides the feedwater lines then, that
15 you're analyzing? What other lines are there? How
16 many total lines are there that you're analyzing?

17 MR. FITZPATRICK: It's hard to say without
18 seeing the whole database in front of me. If you look
19 at how this is picked out, look at page 16, for
20 example.

21 JUDGE WARDWELL: Sixteen? Say that -

22 MR. FITZPATRICK: One six.

23 JUDGE WARDWELL: One six of what?

24 MR. FITZPATRICK: Of the same figure. E-
25 4-30 VY.

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1 JUDGE WARDWELL: And I'm looking at a
2 screen print?

3 MR. FITZPATRICK: Screen, yes. E-4 are
4 the lines -- if you look at the charts down there,
5 there's a box on the left. Each line in the plant,
6 there's a line identifier for each line in the plant.
7 You can click on that, you can get all the piping
8 components from that.

9 This screen, you pick which ones you want
10 to lump together as an analysis. For instance,
11 there's only two lines in this one. And the middle
12 box, 01-16-FD01, and 03-16-FD03, those are two
13 feedwater pumps lines going through the feedwater
14 heater up to the head. And that's -- there's probably
15 50 components total between those two lines. And this
16 is a wear rate analysis of those lines based on the
17 latest inspection. All the data -

18 JUDGE WARDWELL: Then other categories of
19 lines include condensate lines?

20 MR. FITZPATRICK: Condensate lines.

21 JUDGE WARDWELL: Four point extraction
22 steam lines. But you're saying that all the FDWs or
23 anything dealing with the feedwater tends to have this
24 line correction factor?

25 MR. FITZPATRICK: Single phase, but yes.

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1 Those lines, because they're single phase flow.
2 CHECWORKS is under-predicting the wear. I'm sorry,
3 over-predicting the wear with the line correction. If
4 the line correction factor is less than one, it will
5 over-predict the wear.

6 JUDGE WARDWELL: So you predict more wear
7 than is actually there.

8 MR. FITZPATRICK: Yes.

9 JUDGE WARDWELL: When you're below one on
10 your line correction factor.

11 MR. FITZPATRICK: Yes.

12 JUDGE WARDWELL: How many of these run
13 definitions are there? That's a scroll that I see
14 here, and I assume this exhibit doesn't have a plot
15 for every one of the run definitions in the lines that
16 are incorporated under each. I assume that you select
17 a different run definition on the right-hand side of
18 this block that's shown here on the print screen.
19 Then the number of database lines shown on the left-
20 hand changes.

21 MR. FITZPATRICK: Yes. They're individual

22 -

23 JUDGE WARDWELL: And it shows all the
24 groups of the actual lines that CHECWORKS does for
25 each of these run definitions.

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1 MR. FITZPATRICK: The column on the right,
2 yes, represents the different wear rate analysis that
3 are done.

4 JUDGE WARDWELL: And you're testifying
5 that the results for things that aren't feedwater
6 related have line correction factors between .5 and
7 the two that you want, or whatever that number was
8 that you testified. Is that correct?

9 MR. FITZPATRICK: No. The feedwater has
10 line correction factors less than one. Some of the
11 other lines are factor resistant material. We ran in
12 the models, anyway. Their line correction factors can
13 be off, can be high, can be low. Each line is
14 evaluated separately.

15 JUDGE WARDWELL: Right. But I was just
16 saying that Dr. Horowitz said there's been an anomaly
17 that they're trying to resolve in regards to feedwater
18 lines. Is that correct, Dr. Horowitz?

19 DR. HOROWITZ: Yes.

20 JUDGE WARDWELL: And so looking at page 16
21 in these run definitions, everything that's related to
22 feedwater is liable to have that same anomaly that
23 you're wondering about. Is that correct, Dr.
24 Horowitz?

25 DR. HOROWITZ: Yes, that's correct, Judge.

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1 JUDGE WARDWELL: Thank you. Yes, Dr.
2 Hopenfeld?

3 DR. HOPENFELD: I'd like to be fair, so I
4 did go to the next one, which I -- I went to the next
5 figure which I gave, which was E-4-29 at 10. The line
6 correction factor is .649. And if you take a couple
7 of points out of there, there's another horizontal
8 line. However, in this case, I went further to see
9 what the impact would be on the EPU. What are the
10 consequences of that, and they are very severe,
11 because you will think that you will -- 10 years. I
12 took one pipe component with wall thickness of 1-1/4
13 inch when it was installed 34 years ago, or 36 years
14 ago. Then I took that component and I let it corrode
15 at the rate before the EPU. Okay? Then I let it -- I
16 compared the prediction of that component after the
17 EPU, 10 years into the EPU, using the correction for
18 the velocity. And I put a range of corrections.
19 There's no correction, say velocity harder than
20 effect. I included the corrections that I have
21 provided you, which were, I believe, between 2.4 and
22 6, based on data.

23 JUDGE WARDWELL: And you've provided this
24 in the testimony.

25 DR. HOPENFELD: Yes. No, I didn't put the

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1 calculation on -

2 JUDGE WARDWELL: Give us the results.

3 DR. HOPENFELD: Well, the results are that
4 if you use the CHECWORKS prediction on this data, you
5 come in with 5 mils, but the actual is going to be 10
6 mils if you look at that line, twice as much. It's
7 not 50 plus or minus 50, it's twice as much, so you
8 may be thinking your best estimate is five years.
9 Actually going there and cooking it 10 years. So you
10 go on like that for 34 years, suddenly you increase
11 the velocity, you lower the oxygen, although this feed
12 line the oxygen probably was the same, but you
13 increase the velocity. And you increase the velocity
14 over a range, because some components are going to be
15 in the range of velocity I gave. So on the extreme
16 side, you're going to pin it down to .37, then on the
17 higher side, you know, when the velocity effect is not
18 as pronounced, you have .71. In both cases, you're
19 below the -- you're actually below the ASME design
20 thickness.

21 Now, the ASME gave you a stamp and it asks
22 you to be within the ASME limits. Now, we're talking
23 about another issue. They're supposed to meet the
24 ASME requirements of the minimum design thickness.
25 Usually you take the loop cert and that's what it is,

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1 and then you allow corrosion. You make a corrosion
2 allowance, so what we have here, we're exceeding.

3 JUDGE WARDWELL: Okay. What you're saying
4 is you performed a sensitivity analysis to show how
5 sensitive these calculations are to changes in
6 velocity.

7 DR. HOPENFELD: Right.

8 JUDGE WARDWELL: Is that correct?

9 DR. HOPENFELD: Right. But Dr. Hausler
10 has done it in a different way.

11 JUDGE WARDWELL: Dr. Horowitz, have you
12 performed similar sensitivity analysis for all the
13 various input parameters that you showed yesterday on
14 your presentation that go into calculating out the
15 wear from CHECWORKS, and how sensitive is that program
16 to the various -

17 DR. HOROWITZ: I have not done that
18 formally for CHECWORKS, but I can answer your
19 question, because EDF did exactly the sort of analysis
20 you're referring to. And the answer came out to be
21 the single most important variable was chromium
22 content, and everything else was insignificant.

23 JUDGE WARDWELL: So chromium content would
24 be what, your F6, your alloy factor?

25 DR. HOROWITZ: Yes.

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1 JUDGE WARDWELL: That's the most
2 important.

3 DR. HOROWITZ: By far.

4 JUDGE WARDWELL: That's most sensitive to
5 that.

6 DR. HOROWITZ: By far. And the reason is
7 - let me finish - is that the normal carbon steel pipe
8 with fittings, the chromium level is unknown, between
9 zero and .4 percent. And so you can have one piece of
10 pipe that has a low amount of chrome and out of wear,
11 another piece of pipe has .2 percent of the loop cert.

12 JUDGE WARDWELL: Do you recall what the --
13 which of these factors are influenced by velocity of
14 your seven factors?

15 DR. HOROWITZ: It would be the mass
16 transfer factor, chromium bromide.

17 JUDGE WARDWELL: As is mass -- so velocity
18 influences mass transfer, we're really getting into an
19 argument or a discussion of whether or not that's a
20 linear relationship between mass transfer and an
21 exponential relationship. Is that correct?

22 DR. HOROWITZ: A little more complicated,
23 but essentially.

24 JUDGE WARDWELL: I've got to call you one
25 more time, Dr. Hopenfeld. From now on, if I don't

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1 have a question for you, I'd like for you not to raise
2 your hand. We're not in school here. Okay? I don't
3 have a question, but go ahead.

4 DR. HOPENFELD: Well, I just wanted to
5 make a comment on the line -- I wasn't telling you
6 anything different. Dr. Hausler has information, or
7 would like to comment about the completeness of my -

8 JUDGE WARDWELL: And I understand that,
9 and if I have a question for Dr. Hausler, I will ask
10 it. The reason I say that, Dr. Horowitz, is because -
11 - I mean Dr. Hopenfeld -

12 DR. HOPENFELD: I understand.

13 JUDGE WARDWELL: -- is that we have the
14 pre-filed testimony. Some of the testimony is clearer
15 to understand than others. And it's not to say that
16 the amount of questioning is any relationship to the
17 weight of the testimony. It's all weighted equally,
18 and then evaluated in regards to its credibility. But
19 it may be just that his testimony is clearer, so I
20 personally don't have questions.

21 DR. HOPENFELD: I apologize.

22 JUDGE WARDWELL: Well, I'll get it to when
23 I come down. I have a list of questions in regards to
24 velocity. Rather than trying to find it, I'd rather
25 go through mine in the order of things. It will take

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1 more time for me to find it than when we eventually
2 get to it.

3 Are there any other factors in here --
4 but, Dr. Horowitz, it's fair to say, though, that it
5 would be argumentative in regards to whether or not
6 the mass transfer factor would, in fact, have a bigger
7 -- a larger impact on the ultimate results as you
8 change mass transfer if, in fact, you incorporated
9 some other relationship between that parameter and
10 velocity. If you use an exponential relationship
11 between that, in fact, your F2 factor dealing with
12 mass transfer would have a very large impact on the
13 ultimate results.

14 DR. HOROWITZ: Sure.

15 JUDGE WARDWELL: Is there any other one,
16 the temperature, geometry, pH, or oxygen factor that
17 would be highly sensitive in regards to testimony that
18 has been presented by NEC in this proceeding that you
19 wish to defend?

20 DR. HOROWITZ: Thank you for the
21 opportunity to defend the program. The other factor
22 that has been discussed in testimony has to do with
23 the concept of geometry factor. In fact, Dr.
24 Hopenfeld alluded to that earlier.

25 He questions the use of the concept of

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1 geometry factor to relate a lot of geometry factors.
2 The geometry factor relates the maximum corrosion rate
3 in the fittings to the maximum corrosion rate in
4 equivalent straight pipe. This approach was
5 originated by Mr. Keller in Germany in the early '70s,
6 and it's used in every crack prediction method that
7 I'm aware of, including the other programs I mentioned
8 this morning, this afternoon.

9 The concept of geometry factor we related
10 in our testimony to loss coefficients and pressure, so
11 what we do, though, is not relate an average parameter
12 but a local parameter. And so if you have an elbow,
13 we've looked at a lot of data, and taken the maximum
14 corrosion rate in the elbow, looked at the attached
15 pipe, looked at the corrosion rate there in the gear
16 shift. Admittedly, there's a scatter in the process,
17 but on the other hand, you get a result that's easy to
18 use, and works well enough for our purposes.

19 The other approach Dr. Hopenfeld
20 mentioned, and he quoted a reference, and that's
21 probably the first and only reference. If you use
22 computational fluid dynamics, you can say I might be
23 able to get a better answer, but you have to have
24 detailed modeling in whatever area you're looking at.
25 So if you have an accident occurring, and you want to

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1 spend some time to really understand it, that's
2 perhaps a good approach. But that's not what we do in
3 CHECWORKS. CHECWORKS is a tool to help you pick
4 inspection locations. The use of geometry factors for
5 this purpose seems to work fine.

6 If you bear with me for two more sentences
7 or so. Last May there was a failure in a fossil plant
8 in Missouri, two men were killed. The utility hired
9 a consulting firm, did a CFB analysis and the stuff,
10 to look at that thing in great detail. They also
11 hired a consulting firm to do the CHECWORKS analysis
12 of all their single phased piping. In 1800 components
13 in single phase, the failure location was in the top
14 five CHECWORKS, so I think it works pretty well.

15 JUDGE WARDWELL: Is that your only
16 indication that CHECWORKS works well? Do you have
17 anything else from the -- either Vermont Yankee or the
18 rest of the nuclear industry that demonstrates the
19 ability of this program to predict wear? I mean, as
20 I look at those line correction factors, I'm not very
21 enthusiastic in regards to everything dealing with the
22 feedwater system.

23 DR. HOROWITZ: I understand, and I agree.
24 But I can't think of anecdotal experience off hand as
25 good as that one, but on the other hand, as I said

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1 before, there are other programs available. And if
2 people are unhappy with CHECWORKS, I don't see anybody
3 flocking to try it. I think that's -

4 JUDGE WARDWELL: In regards to the
5 geometric features or factors, does these count for
6 discontinuities in any manner within the geometry of
7 the component?

8 DR. HOROWITZ: The experience has been
9 that small discontinuities, irregular welds, do not
10 have a major effect on result. The problem you get
11 into is one that if you know -- you have no way of
12 knowing what the detailed discontinuities are unless
13 you do a radiographic inspection. So you have a
14 feedwater line over there that you want to inspect,
15 you can only use the information you know, and that's
16 the gross characteristics of the piping system.

17 JUDGE WARDWELL: You have referenced E-4-
18 08 in your testimony, and we've been looking at it.
19 I'm not sure I saw the date on that, and I was curious
20 about the date of that publication.

21 DR. HOROWITZ: Excuse me. Would you
22 repeat the number, please?

23 JUDGE WARDWELL: E-4-08. It's the flow-
24 accelerated corrosion in power plants, Revision 1, NEC
25 03-7446. So, obviously, the interveners have

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1 published this document. That's a joke, boy. I'm
2 laughing.

3 (Off the record comments.)

4 DR. HOROWITZ: What page?

5 JUDGE WARDWELL: Just -- I don't know
6 where there's a date on it. I can't give you a page,
7 because there is no date. I was curious of the date.

8 MR. FITZPATRICK: E-4-08?

9 JUDGE WARDWELL: Yes. When was that
10 published?

11 DR. HOROWITZ: It was published, the Rev.
12 1, 1998.

13 JUDGE WARDWELL: Thank you. Explain
14 again, Dr. Horowitz, what the results of CHECWORKS
15 provides to someone like Mr. Fitzpatrick in regards to
16 selecting the components for inspection. I gather it
17 doesn't dictate it, but that it just presents where
18 the -- well, you tell me what it presents in order,
19 and then how Mr. Fitzpatrick - or you can turn it over
20 to him on how he actually selects the points.

21 DR. HOROWITZ: What the program does for
22 each analysis line is presents predicted wear rate,
23 and predicted total wear for that component. For
24 components with measured data, it also compares the
25 predicted wear with the measured wear at the time of

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1 that inspection. That's the main thing it does.

2 JUDGE WARDWELL: Does it rank it in any
3 fashion, or highlight those that are a certain
4 criteria?

5 DR. HOROWITZ: At the user's option, you
6 can sort it, mix and match, whatever. And the other
7 thing that's presented is time to reach a user-defined
8 critical thickness.

9 JUDGE WARDWELL: And that's presented in
10 just a results tabular fashion?

11 DR. HOROWITZ: Those are those tables we
12 were looking at earlier.

13 JUDGE WARDWELL: And there's no other
14 editorial or recommendational type of subfunction that
15 gives it any other weight or emphasis besides -

16 DR. HOROWITZ: Yes. As far as CHECWORKS
17 is concerned, that's exactly right. There are third-
18 party software add-ons that do back-end calculations,
19 but that's not -

20 JUDGE WARDWELL: So, Mr. Fitzpatrick, how
21 do you use that now to dictate the selection of the
22 inspection points? What criteria do you use? What
23 determines where and how many inspections you will
24 conduct?

25 MR. FITZPATRICK: Can I walk you through

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1 what we did, the example we did?

2 JUDGE WARDWELL: Sure.

3 MR. FITZPATRICK: E-4-40 would be the
4 previous outage.

5 JUDGE KARLIN: Could you speak up, sir?

6 MR. FITZPATRICK: E-4-40. These were for
7 the 2004 outage. The old program name is on the top.
8 The process is the same. Go to page -- well, the
9 first page lists the criteria. We match the criteria
10 in the procedure. On the first page, lateral piping.
11 This is just a general list, and then there's a
12 selection process in the following pages. Components
13 selected from where from previous inspections. We
14 identify the susceptible ones in CHECWORKS. We use
15 industry experience points, the nuclear --

16 JUDGE WARDWELL: Well, let me interrupt.
17 I'm rather -- I guess I don't want the example. I'd
18 rather know what's your philosophy on it. I don't want
19 to just go through it, and read what you did. I want
20 to know what you're thinking. I mean, you got these
21 results, and now you've got to interpret them. What
22 do you do to interpret them?

23 MR. FITZPATRICK: The CHECWORKS?

24 JUDGE WARDWELL: Yes. How do you
25 interpret, and then take that CHECWORKS data and end

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1 up with this as a result?

2 MR. FITZPATRICK: Whatever CHECWORKS
3 results you have at that time. You look at components
4 with the highest wear rates that you don't have any
5 inspection data on. You can select those.

6 JUDGE WARDWELL: So you'll sort it by
7 highest wear rates.

8 MR. FITZPATRICK: Or pick them out.
9 That's one inspection. Highest wear rates is one
10 criteria. The time to t min predicted by CHECWORKS
11 for the event, inspection data on that component.
12 That's another factor. And then other areas of the
13 model, if we don't have that much inspection for that
14 -- data for that one line, we will add components in
15 to help work on a correct correlation.

16 JUDGE WARDWELL: Do you do this yourself?

17 MR. FITZPATRICK: Yes.

18 JUDGE WARDWELL: Does anyone else do it
19 separately, and then you get together and compare
20 notes to see whether you both reached the same
21 conclusion, or is it just you do it?

22 MR. FITZPATRICK: I do it, and another
23 engineer reviews it. He may add more components and
24 say why are you doing these? And it's a peer review
25 thing.

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1 JUDGE WARDWELL: But it isn't a separate
2 analysis, it's a review of your's.

3 MR. FITZPATRICK: Yes.

4 JUDGE WARDWELL: Dr. Horowitz, does
5 CHECWORKS use average velocities, or maximum
6 velocities in its mass transfer coefficients?

7 DR. HOROWITZ: CHECWORKS uses average
8 velocities.

9 JUDGE WARDWELL: Is there a reason for
10 that?

11 DR. HOROWITZ: Yes. The reason is that's
12 the available number for the plant. There's the mass
13 flow rate, easily converted velocity.

14 JUDGE WARDWELL: Are there usually -- is
15 there much difference between those two, and which
16 would be the most likely to influence flow accelerated
17 corrosion, and how would it possibly impact the
18 CHECWORKS results?

19 DR. HOROWITZ: Excuse me. You're asking
20 from average to maximum velocity?

21 JUDGE WARDWELL: No. I said what would be
22 the difference between average and maximum velocities,
23 and what effect would it have on the mass transfer
24 rates, in your professional opinion?

25 DR. HOROWITZ: If I understand the

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1 question correctly, you're saying you have a component
2 that over the course of a cycle your velocities vary
3 with time. Is that the sense, or is it something
4 different?

5 JUDGE WARDWELL: All of that, but is there
6 a uniform -- is it uniform velocity in all the
7 components in the cross-section also? There's both a
8 time faction, there's a time factor, there's a life
9 factor, I assume, and it's liable to vary at various
10 lengths, various positions along your total line. And
11 there may be a cross-sectional, any of those?

12 DR. HOROWITZ: Thank you. I understand
13 what you're driving at. First of all, the way nuclear
14 plants run, they basically run at the same conditions
15 for long periods of time. So, temporally we use the
16 average velocity corresponding to the power plants'
17 run time.

18 As far as geometric changes in local
19 velocity due to things like elbows, like Dr. Hopenfeld
20 and Dr. Hausler both pointed out in their testimony,
21 and other geometrical fittings, what we use is we use
22 the average velocity in the cross-section, and we use
23 the geometry factors to correct for the different flow
24 patterns that occur in elbows, for example. So we use
25 average velocity for everything the user doesn't have

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1 to be concerned about variations of velocity, say
2 downstream of an orifice, or an elbow, or whatever.

3 JUDGE WARDWELL: Can I get a feeling on
4 how well these line works in package form? You have
5 assumed a linear velocity relationship with mass
6 transfer.

7 DR. HOROWITZ: Yes. Let me say, I can't
8 say in detail, but it's close.

9 JUDGE WARDWELL: I promise you I won't
10 steal it and go write a program. I understand. If,
11 in fact, it was exponential say to a 1.1 factor, or
12 anything really, 1.5, 2, whatever, in reality, and you
13 were incorporating a linear relationship, would not
14 that show up after the next plant inspection was
15 incorporated into the CHECWORKS program in a new
16 linear line correction factor, because you would be
17 off by quite a bit, wouldn't you?

18 DR. HOROWITZ: Yes. I think that -

19 JUDGE WARDWELL: As Dr. Hopenfeld has
20 said.

21 DR. HOROWITZ: You'd be off quite a bit,
22 and you would be off -- see, the velocity changes not
23 only something like a power uprate, but also changes
24 if you have a T and you add flow, so downstream end of
25 the Ts increase, or if you have a reducer. You have

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1 an eight inch pipe going to a six inch pipe, the
2 downstream velocity is roughly twice. And I think if
3 we were off in that manner, we were off as far as the
4 velocity exponent, that would be about the first thing
5 the user would see, that they would see that the
6 upstream pipe, upstream components, or the downstream
7 components, that the eight inch and the six inch
8 components are way different. The eight inch would be
9 over-predicted, and the six inch would be under-
10 predicted based on a higher velocity power. So I am
11 quite confident that the velocity power functionality
12 we use is correct, because nobody has complained in 20
13 years about it.

14 JUDGE WARDWELL: How strong an influence
15 is a line correction factor in trying to correct any
16 of your less than accurate assumptions that you've
17 made in your correlations, or just your error bar in
18 your correlations for the various six or seven
19 factors? Is it -- let's say you went in there right
20 now and put in a relationship between velocity and
21 mass transfer to the fourth power. Maybe that's a
22 little extreme, but I'm just curious. I want to get a
23 feeling for how fast the line correction factor would
24 compensate for that based on comparing your predicted
25 data to the actual measured data.

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1 DR. HOROWITZ: I believe I can understand,
2 and I'll try to answer that. The line correction
3 factor does different things depending on different
4 situations. For example, if you have variations in
5 plant water chemistry in some range, the engineer has
6 to make an estimate of what technical value to use,
7 and that introduces a non-linearity.

8 In the case that hypothetically if you
9 change the model, whatever power you want, fourth say,
10 and the situation -- if you just had a straight piece,
11 say you had a straight piece of pipe, same diameter
12 elbow, other elbow, other piece of pipe, and you did
13 it, the line correction factor would solve that
14 problem, even though your model is way off, because
15 it's modifying all the results by the same event.

16 The problem would come in, and I think it
17 would be noticeable, is if the velocity is changing
18 along the line. If you have change in pipe diameter,
19 change in flow rates -

20 JUDGE KARLIN: Mr. Raubvogel, could we
21 minimize the conversations over at NEC's table,
22 please?

23 MR. RAUBVOGEL: Yes, sir.

24 JUDGE KARLIN: Thank you. Please proceed,
25 Dr. Horowitz.

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1 DR. HOROWITZ: I don't know, but my
2 speculation is that the user would see a very large
3 amount of scatter. If he were curious enough to take
4 a look, he would see that the low velocity points were
5 here, and the high velocity points were there, and say
6 something is messed up with the model, because that's
7 not what you wanted to see.

8 JUDGE WARDWELL: In a general sense for
9 all of the factors, is it fair to say that your model
10 is not designed to rely on the line correction factor
11 to correct gross errors in any of your correlation,
12 but more to fine tune the results to be a better
13 predictive tool?

14 DR. HOROWITZ: Yes, that's exactly right.

15 JUDGE WARDWELL: So you can't count on
16 that to make up for bad correlations in your -

17 DR. HOROWITZ: That's exactly correct.

18 JUDGE WARDWELL: And it is -- your
19 correlations being proprietary, and rightfully so, are
20 unknown to us, but it sounds pretty much that they're
21 based on empirical data, as opposed to a theoretical
22 solution of any hydraulic or other heat transfer, or
23 any of the other types of things that may relate to
24 each individual factor?

25 DR. HOROWITZ: Yes, that's a fair

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1 statement. We understand the scientific
2 underpinnings, but the correlation itself is
3 correlation.

4 JUDGE WARDWELL: So, in essence, it's
5 built on plant data from a number of sources to start
6 with.

7 DR. HOROWITZ: Absolutely.

8 JUDGE WARDWELL: Built on not a
9 theoretical solution that you're trying to now apply
10 to this, but is built on hey, this is what we've seen.
11 Did it take place over the years?

12 DR. HOROWITZ: That is correct.

13 JUDGE WARDWELL: How much of that data is
14 related to the power levels we're dealing with here
15 for line eight?

16 DR. HOROWITZ: The power level as a
17 percent, the power level as a power, or -

18 JUDGE WARDWELL: Well, you tell me, but I
19 believe it would be more important to be the absolute
20 level of power, rather than just the fact that it's
21 gone up 20 percent. That's important at Vermont
22 Yankee. I mean, yes, it's -- the increase of 20
23 percent is important, but that number has no magic.
24 It would be the absolute power number, it seems to me,
25 that would be the most important. Am I thinking

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1 correctly?

2 DR. HOROWITZ: CHECWORKS covers the range
3 of conditions at Vermont Yankee. It covers the range
4 of conditions at operating light water reactors. The
5 change at Vermont Yankee is primarily one of velocity,
6 and the velocity, checked with Mr. Fitzpatrick the
7 other day, maximum velocity is just under 25 feet a
8 second in the feedwater system, and this is comparable
9 with any number of other plants.

10 JUDGE WARDWELL: And what is the absolute
11 power level there that's now being used, Mr.
12 Fitzpatrick, at Vermont Yankee? What are we at?

13 MR. FITZPATRICK: Power level?

14 JUDGE WARDWELL: Yes.

15 MR. FITZPATRICK: 1912 megawatts thermal.

16 JUDGE WARDWELL: Have you looked at the
17 distribution of your data that generates these
18 correlations, Dr. Horowitz, as it relates to various
19 absolute power levels? My question focused towards,
20 is there, in fact, a bias in your program towards the
21 lower power levels, in fact, masking some of the
22 effects associated with the higher power levels, such
23 that Vermont Yankee is at?

24 DR. HOROWITZ: The answer to the first
25 part of your question is no. We assembled most of the

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1 data and most of the re-validation before anybody was
2 thinking about power uprates. In fact, originally
3 around '88, and later about '94-95 -

4 JUDGE WARDWELL: So most of those were at
5 what power level, about?

6 DR. HOROWITZ: There were, as I recall, 30
7 different units. I can tell you, but I'd have to dig
8 out the information.

9 JUDGE WARDWELL: Would you have a rough
10 idea, Mr. Fitzpatrick? Well, what were you before the
11 power uprate?

12 MR. FITZPATRICK: 1593.

13 JUDGE WARDWELL: And that's thermal,
14 right?

15 MR. FITZPATRICK: Megawatts thermal. His
16 direct inputs are really the velocity and
17 temperatures, and that could be -- our 120 percent
18 power and velocity and temperature is conducted at 80
19 percent power in another plant.

20 JUDGE WARDWELL: That's my point.

21 MR. FITZPATRICK: Yes.

22 JUDGE WARDWELL: But my point is also, how
23 does that compare to the range of velocities and
24 temperatures, or power, whichever you want to call it.
25 I guess they're pretty much analogous, to the data

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1 that was used to generate the correlations. What I'm
2 concerned about is that we're masking the effects of
3 the higher power level at Vermont Yankee but this huge
4 database of information from the other plants that
5 were at a lower power level. And has anyone
6 considered getting rid of some that database that's at
7 the lower power level, and only dealing and
8 calibrating CHECWORKS based on the range of power
9 levels that are there?

10 DR. HOROWITZ: Again, I couldn't list for
11 you today the -- like I said, about 30 units, whatever
12 it was, that we used, but even though this has been a
13 while ago, Vermont Yankee with the uprate is still a
14 fairly small plant in terms of power level. I can't
15 really see how -

16 JUDGE WARDWELL: So they're at the low
17 end, you say, of your database, you believe?

18 DR. HOROWITZ: I would speculate so,
19 because 600 megawatts electric is still a pretty small
20 plant. And I'd kind of be surprised the other way if
21 they have a lot of plants that small, they're the
22 plant on the computer.

23 JUDGE WARDWELL: Dr. Horowitz, do you know
24 off the top of your head what the oxygen levels were
25 before the switch to hydrogenated water, and what

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1 effect that had on the oxygen levels, and what
2 resulting effect that might have on the CHECWORKS
3 results and prediction capabilities?

4 DR. HOROWITZ: I don't know off-hand the
5 level. I can discuss at great length more if you want
6 to hear, hydrogenated water. Jim, do you know?

7 MR. FITZPATRICK: The oxygen levels are
8 the same as before, around the same amount of oxygen -
9 - the same amount of oxygen is injected in the lines.
10 We didn't reduce oxygen levels in the feedwater piping
11 in order to introduce -- as the content of the
12 feedwater piping where it's introduced to the reactor
13 for power uprate. There was no drastic change in
14 oxygen levels introduced in the feedwater condensate
15 piping.

16 JUDGE WARDWELL: So are you testifying
17 that the dissolved oxygen is the same in the water
18 system after the hydrogenated water efforts?

19 MR. FITZPATRICK: In the feedwater and
20 condensate, yes. The CHECWORKS model has an option
21 for the hydrogen water chemistry, and they included
22 that change when that occurred in the CHECWORKS notes.
23 It affects steam system and other parts of the
24 chemistry calculations they use.

25 JUDGE WARDWELL: And did you see -- that

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1 certainly changed your oxygen level in those systems,
2 though, didn't it?

3 MR. FITZPATRICK: In the steam system -

4 JUDGE WARDWELL: Right.

5 MR. FITZPATRICK: Most of those are crack-
6 resistant material.

7 JUDGE WARDWELL: Thank you. What about
8 this local flow velocity, the potential for turbulence
9 that Dr. Hopenfeld brought up in regards to one of the
10 components he's concerned about, do you have any
11 comments on that?

12 DR. HOROWITZ: Yes. We believe the
13 geometry factor accounts for that local turbulence.
14 That's what causes the factor to be greater than one.

15 JUDGE WARDWELL: Mr. Fitzpatrick, how
16 large is your grid size that you use for your
17 inspection program?

18 MR. FITZPATRICK: It's a function -- it
19 varies with the size, the outside diameter of the
20 pipe. To carry on the procedure, there's a chart for
21 diameter to grid size that is used.

22 JUDGE WARDWELL: Give me a range of
23 things. Give me your largest pipe in the grid size,
24 and the smallest pipe that you do inspections on, the
25 grid size -

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1 MR. FITZPATRICK: One to six inch diameter
2 we use a one inch grid spacer.

3 JUDGE WARDWELL: A one inch?

4 MR. FITZPATRICK: One inch.

5 JUDGE WARDWELL: Thank you.

6 MR. FITZPATRICK: And it goes up, eight to
7 ten is a two inch. Twelve to fourteen is a three
8 inch. Sixteen to eighteen is a four inch.

9 JUDGE KARLIN: Are you reading from an
10 exhibit, sir?

11 MR. FITZPATRICK: Yes.

12 JUDGE KARLIN: Okay. Can you cite that?

13 MR. FITZPATRICK: There's two exhibits
14 that show it. Sorry. It's the fact program procedure
15 itself. I left my glasses at the -

16 JUDGE KARLIN: Well, maybe you can tell us
17 that after the break.

18 DR. HOROWITZ: It's EN-25 at page 6.

19 JUDGE KARLIN: Thank you.

20 JUDGE WARDWELL: One last question before
21 we break. Are you presently using the current version
22 of CHECWORKS?

23 MR. FITZPATRICK: Yes.

24 JUDGE WARDWELL: And that version is?

25 MR. FITZPATRICK: It's SFA 2.2. The

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1 version was done the end of last year into this year.

2 JUDGE WARDWELL: Okay.

3 JUDGE KARLIN: All right. We've all been
4 on the stand for a while. Things are getting warm.
5 Let us take a break. Because we are hoping to
6 complete today, I think we should just take a 10-
7 minute break, so we will be adjourned for 10 minutes.

8 (Whereupon, the proceedings went off the
9 record at 2:28 p.m., and went back on the record at
10 2:39 p.m.)

11 JUDGE KARLIN: I would remind the
12 witnesses you are still under oath, and we proceed
13 with questioning on Contention Number 4. Dr.
14 Wardwell?

15 JUDGE WARDWELL: Mr. Fitzpatrick, how did
16 you determine those grid sizes that you gave us just
17 before the break? Was there a method that you did, or
18 is it just pulled out of a hat?

19 MR. FITZPATRICK: No. They were
20 recommended in NSAC, and even before NSAC-202 they
21 were in the NUMARC guidelines that were developed
22 after the Surry accident. It evolved over time.

23 JUDGE WARDWELL: Is there a procedure in
24 NSAC that is available to calculate out?

25 MR. FITZPATRICK: It's not procedure. I

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1 think it's presented as a table, a recommended grid
2 size. After we -- I think EPRI some work in the
3 beginning that related to reinforcing poles and pipe
4 and how much extra reinforcing they had to have, if
5 you had a flaw in that grid size. There may be pipe
6 without the flaw which would still meet the code.
7 That's the theory behind it.

8 JUDGE REED: So you told us how large the
9 grid size is, but I don't have a feel for the extent
10 of the grid. In other words, how many of these -- oh.

11 MR. FITZPATRICK: If you have a 12-inch
12 pipe, you might have, geez, 12, 16 around, depending
13 on, you know -- they divide that and try to make it
14 even.

15 JUDGE REED: And to what extent axially
16 along the pipe?

17 MR. FITZPATRICK: That's what I was going
18 to get to. Typically, we do -- if it's an elbow into
19 the entire elbow --

20 JUDGE REED: Okay. All the way around --

21 MR. FITZPATRICK: Yes. You paint the pipe
22 with the grid line and mark Xs. It represents the
23 elbow.

24 JUDGE REED: Okay.

25 MR. FITZPATRICK: The downstream pipe is

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1 two diameters. And so the flow inspector is 24
2 inches.

3 JUDGE REED: And, again, all the way
4 around.

5 MR. FITZPATRICK: All the way around, so
6 you end up with a matrix 12 by 14 or 12 by 20.

7 JUDGE REED: Thank you.

8 JUDGE WARDWELL: What led you to believe
9 that was sufficient diameters downstream from the
10 elbow that you needed the inspections to take place?
11 Dr. Horowitz?

12 DR. HOROWITZ: The procedure in NSAC, and
13 the procedure most people follow -- or everybody
14 follows -- is you inspect within the first two
15 diameters, and if you see any degradation continuing
16 you follow -- you follow the degradation. Normally,
17 though, the weardown screen or the fittings, accepted
18 orifice, is pretty close to the -- the maximum wear in
19 the pipe is pretty close to the rim.

20 JUDGE WARDWELL: NEC -- I'll start with
21 Dr. Hopenfeld, what do you feel is the minimum number
22 of diameters that should -- do you agree with that
23 procedure?

24 DR. HOPENFELD: No, I don't.

25 JUDGE WARDWELL: And what do you think it

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1 should be?

2 DR. HOPENFELD: It depends. If we take a
3 look at NEC JH-24 at 65, also if you would look after
4 that at --

5 JUDGE WARDWELL: Let's start with one at
6 a time. Because if you give us more than one, it
7 doesn't help us. 53 --

8 DR. HOPENFELD: 53.

9 JUDGE WARDWELL: This is JH, correct?

10 DR. HOPENFELD: JH-63 at 65. This is
11 Japanese data from --

12 JUDGE WARDWELL: Well, we're looking at a
13 figure that's unnumbered. It says, "Investigative
14 Results of Thinning at Secondary System," is that
15 correct?

16 DR. HOPENFELD: Okay. You see a valve in
17 the envelope, correct?

18 JUDGE WARDWELL: Yes, that's in the --
19 you're speaking of the flow pattern analysis around --

20 DR. HOPENFELD: Yes.

21 JUDGE WARDWELL: -- small square in the
22 lower left-hand corner of this figure on page 65.

23 DR. HOPENFELD: Correct. That's correct.
24 If you look at this, what happened here, there was a
25 flow disturbance in the valve, and that flow

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1 disturbance affected the flow turbulence further
2 downstream.

3 JUDGE WARDWELL: Thank you. Let me
4 interrupt you right there.

5 Mr. Fitzpatrick, have you found that yet?

6 MR. FITZPATRICK: I'm trying to find the
7 page.

8 JUDGE KARLIN: He's got it.

9 DR. HOPENFELD: And the question is -- if
10 we get this scalar VY, we would model the pipe
11 downstream and the valve, an elbow, and another plant.
12 So there would be three components inspected
13 downstream of that valve, and we would probably
14 inspect them all.

15 JUDGE WARDWELL: So your two diameters
16 doesn't -- isn't -- doesn't affect -- well, it would
17 still stay, but you've got a countervailing component,
18 so you would analyze that.

19 MR. FITZPATRICK: Yes. Strike that as a
20 component. You go two diameters from the well to the
21 vertical pipe to the left.

22 JUDGE WARDWELL: And if you happen -- if
23 there happened to be some other component within those
24 two diameters, then you would start to -- you would
25 model that and then start -- you'd measure that and

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1 then go on until you found two diameters of straight
2 pipe beyond the components, is that correct?

3 MR. FITZPATRICK: If the component is in
4 -- if you have a component in two diameters, it's in
5 the CHECWORKS model, or whatever distance it is, it's
6 in the CHEC --

7 JUDGE WARDWELL: Can you give us an
8 example where there aren't these components in it,
9 just -- what would you say the amount of diameters
10 downstream should they be taking measurements on a
11 straight piece of pipe beyond an elbow?

12 DR. HOPENFELD: Well, as we talked about
13 yesterday, about cross-threading, would be a minimum
14 something like 25 to 45 diameters. That's the
15 engineering number.

16 JUDGE WARDWELL: And what basis is that?
17 Does anyone else -- is that someone else's --

18 DR. HOPENFELD: This is a customary --
19 there was no number that has been around in any
20 textbook or handbook for the last -- for a while, many
21 years -- the section where the flow is fully
22 developed.

23 JUDGE WARDWELL: Do we need to be in the
24 fully developed flow based on the program they set for
25 flow accelerated corrosion where they are applying

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1 CHECWORKS?

2 DR. HOPENFELD: No. We need to do that.
3 We never had it. We looked at the data. I think if
4 you look at the piping, it's so -- they are hardly
5 anywhere there. But --

6 JUDGE WARDWELL: Dr. Horowitz said that
7 they measured the two diameters. If they find wear,
8 then they expand the program.

9 DR. HOPENFELD: It's not sufficient. Two
10 diameters of flow is not -- is not very much at all.

11 JUDGE WARDWELL: Have you shown any
12 difference, Mr. Fitzpatrick? Have you shown excessive
13 wear using your approach in the straight pipes beyond
14 the component?

15 MR. FITZPATRICK: No, we haven't. We have
16 looked at four lines, six diameter, four specific
17 lines in the feedwater line, six feet of measurements,
18 have a 10-inch pipe. So it's -- we haven't seen any.

19 Also, I think the flow is fully developed
20 for the velocities that we have for these elbows.

21 JUDGE WARDWELL: Dr. Hausler, did you
22 comment on the floor diameters -- I can't remember --
23 in your testimony? And, if so, would you like to say
24 anything in regards to what you feel is the number for
25 the diameters?

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1 DR. HAUSLER: No, Your Honor. I did not
2 comment directly on it. However, I would like to make
3 a very brief comment. The important consideration is
4 where the point of reattachment occurs. That is, if
5 you flow through an orifice, you get turbulence near
6 the orifice -- downstream of the orifice, near the
7 orifice you get an eddy, you know, close by. You
8 know, you get a point of reattachment of the flow on
9 the pipe.

10 At that point, the reattachment moves
11 further away where the higher velocity is. And that
12 is the consideration that says, you know, how many
13 diameters you have to be away, you know, from -- pipe
14 diameters you have to be away from the obstruction.

15 Now, it kind of sticks in my mind that
16 it's more than two, but I -- I cannot --

17 JUDGE WARDWELL: Thank you for that
18 explanation.

19 Mr. Fitzpatrick, do you disagree with the
20 description that Dr. Hausler just provided? And has
21 that been considered in your selection of the
22 diameters downstream of the component?

23 MR. FITZPATRICK: I believe he is talking
24 plate orifices for flow through an orifice, a regular
25 plate orifice. For the orifices in the main process

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1 steam feedwater condensate at VY, the Venturi is a
2 pipe that -- shaped Venturi, smooth transition, smooth
3 bore area, and a smooth transition out.

4 We have looked two, three, even four
5 diameters downstream, and a number of fittings
6 downstream, and we haven't found any wear.

7 JUDGE WARDWELL: Thank you.

8 Dr. Horowitz, why wouldn't the water
9 chemistry change during the power uprate and have an
10 influence? Or does it have no influence -- have very
11 little influence on your results, in addition to the
12 flow rates and temperature?

13 DR. HOROWITZ: Well, let me just make one
14 comment. The two diameters here comes from British
15 data for orifices, and the point of maximum wear
16 downstream of an orifice as determined by a lot of
17 British data is about one to one and a quarter
18 diameters. So two diameters would capture steam from
19 orifice.

20 Hydrogen water chemistry power uprate, the
21 power uprate by itself shouldn't change the water
22 chemistry in the areas of interest, because you're
23 still injecting enough oxygen to bring the feedwater
24 concentration up to about 40 parts per billion. So
25 you're running a little water, you are just running

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1 more oxygen. As virtually all of the areas of
2 interest and from what I can see from what FAC are
3 concerned, that's the water chemistry they see.

4 JUDGE WARDWELL: Dr. Hausler, do you agree
5 that the water chemistry would change with the power
6 uprate? Or do you have any opinion?

7 DR. HAUSLER: No, I don't think that the
8 water chemistry would be directly affected by the
9 power uprate. However, what does happen is that in
10 the corrosion process oxygen is actually consumed.
11 And as the mass transfer of oxygen through the pipe
12 increases because of increased velocity, more oxygen
13 is being consumed. That will affect, of course, the
14 corrosion rate that one observes downstream of the
15 pipe from, you know, wherever oxygen is injected.

16 What that means, basically, is that you
17 cannot assume that the oxygen concentration is
18 constant through the flow path.

19 JUDGE WARDWELL: Mr. Fitzpatrick, do you
20 have any observations that indicate that that -- that
21 the oxygen does maintain constant, or in fact is
22 altered by the corrosion that is taking place -- the
23 increased corrosion that is taking place with the
24 increased flow rate?

25 MR. FITZPATRICK: That's a chemistry

1 question, and I think Dr. Horowitz would be a better
2 person to address that.

3 JUDGE WARDWELL: That's fine.

4 MR. FITZPATRICK: But we measure oxygen
5 going in, and that doesn't seem to do anything but
6 change, it would suggest that, but I'm not sure.

7 JUDGE WARDWELL: You say you are seeing
8 changes in regards to what he's suggesting, or you
9 don't see any changes that would support what he's
10 suggesting?

11 MR. FITZPATRICK: No, in our measurements
12 in oxygen, it is pretty much constant the entire
13 metrics that we see.

14 JUDGE WARDWELL: Dr. Horowitz?

15 DR. HOROWITZ: I was going to say I
16 believe Dr. Hausler is correct, but I don't think it's
17 a first order impact. I think the amount could change
18 and oxygen levels could be pretty small.

19 JUDGE WARDWELL: Thank you.

20 Dr. Hopenfeld, do you believe the water
21 chemistry changes with the power uprate?

22 DR. HOPENFELD: It's hard to tell, because
23 talking to the CDTP people, looking back a long time
24 ago, and looking at the data, it's not that simple.
25 You see a lot of the surface act as debtor, you have

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1 sources and sinks in that place. But Dr. Hausler
2 isn't really running something of a calculation on
3 model, telling you what happened to the oxygen,
4 because there is an indication that there oxygen is
5 being consumed. And, therefore, it is almost
6 impossible to answer your question as close as 20
7 percent from the top.

8 JUDGE WARDWELL: Thank you, Dr. Hopenfeld.

9 Mr. Fitzpatrick, isn't it logical to
10 assume that with the increased flow rates that the
11 location for the critical measurements are liable to
12 change with those increased flow rates?

13 MR. FITZPATRICK: I don't believe so.
14 Locations that CHECWORKS shows as having the highest
15 flow rates, highest wear rates, are typically those
16 with the most tortuous geometry, around control
17 valves, the reducers, downstream of valve lines. That
18 won't change. All of the elbows of the model.

19 We already inspected the ones that had
20 previously been -- had been identified as the most
21 susceptible. And as we, over time, expand components
22 we will add more of those.

23 JUDGE WARDWELL: Another thought just came
24 to mind -- it's kind of off the screen -- as you were
25 describing that, your image of what would take place.

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1 But are we or are we not applying this model to both
2 one-phase, single-phase, and two-phase flow, to your
3 system?

4 MR. FITZPATRICK: Yes.

5 JUDGE WARDWELL: And the one-phase flow
6 we're talking about is water, and the two-phase is
7 water and steam.

8 MR. FITZPATRICK: Yes.

9 JUDGE KARLIN: Could you clarify that?
10 Maybe I wasn't listening carefully, but I think you
11 said, "Are we or are we not?" and he said yes. And
12 I'm not sure which one is right.

13 MR. FITZPATRICK: It applies to single-
14 phase piping. Most of the two-phase piping of the
15 model is already constructed with FAC-resistant
16 material.

17 JUDGE KARLIN: Is what?

18 MR. FITZPATRICK: Constructed of FAC-
19 resistant material.

20 JUDGE KARLIN: But are any of -- is any of
21 it not such that you are also modeling two-phase flow
22 at Vermont?

23 MR. FITZPATRICK: We model it, but we're
24 inspecting the remaining locations that are still
25 carbon steel.

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1 JUDGE KARLIN: I think you referenced on
2 A-40 of your testimony that there was -- something in
3 the neighborhood of four and a half years worth of
4 data will be obtained prior to the power uprate I
5 think.

6 MR. FITZPATRICK: That's three cycles, 18-
7 month cycles. We'll have three inspections with our
8 uprate experience.

9 JUDGE KARLIN: And so that will give you
10 three inspections over a --

11 MR. FITZPATRICK: Yes.

12 JUDGE KARLIN: What is the technical basis
13 for you saying that that's sufficient data? That was
14 your argument on -- basically, on A-40.

15 MR. FITZPATRICK: We aren't seeing wear
16 rates now -- any significant wear now in one
17 inspection that is now completed. We don't expect to
18 see any change in the next two inspections. If it
19 does show up in the CHECWORKS models, we'll inspect
20 those components. But we have a high level of
21 confidence that we're not going to see any difference.

22 JUDGE KARLIN: But you are also going to
23 change the location if engineering judgment or all of
24 those other factors indicate that you should also look
25 at other locations, correct? You're not going to rely

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1 solely on the CHECWORKS model?

2 MR. FITZPATRICK: No, sir. We're going to
3 use engineering judgment for the procedure, the steps
4 that we have in place to select components for
5 inspection.

6 JUDGE REED: Could you give us an idea
7 about how many inspection points you have chosen that
8 were not directly selected from CHECWORKS? How many
9 components, engineering judgment as opposed to how
10 many from CHECWORKS, on each inspection? Currently.

11 MR. FITZPATRICK: It's 60 drivable
12 components. It is approximately 60 drivable
13 components selected for the next refueling outage.

14 JUDGE REED: Okay.

15 MR. FITZPATRICK: I don't have this in
16 front of me, I think it's like 10 from CHECWORKS, 10
17 from previous inspection data, and maybe more, I think
18 it will be more. Say 20 from CHECWORKS, 20 from
19 previous inspection data, and the remainder is OE.

20 JUDGE REED: The remainder is what?

21 MR. FITZPATRICK: Operational experience,
22 OE.

23 JUDGE REED: Operational experience.
24 That's engineering judgment or --

25 MR. FITZPATRICK: Other plants --

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1 JUDGE REED: Okay.

2 MR. FITZPATRICK: We get information from
3 INPO and --

4 JUDGE REED: So out of 60 inspection
5 locations, only 20 are coming from CHECWORKS?

6 MR. FITZPATRICK: Well, you could say a
7 third on average.

8 JUDGE REED: A third.

9 MR. FITZPATRICK: Yes.

10 JUDGE REED: If we took CHECWORKS away
11 from you and said, "Don't use it anymore," would it be
12 a major disaster for you?

13 MR. FITZPATRICK: No.

14 JUDGE REED: Okay.

15 JUDGE WARDWELL: Your current flow
16 accelerated corrosion program calls for -- that you
17 had approved for the power uprate.

18 MR. FITZPATRICK: Right. Yes.

19 JUDGE WARDWELL: But then, it ends because
20 that's the end of your license. What's the frequency
21 of inspections for the -- for the extended period of
22 operation?

23 MR. FITZPATRICK: Every refueling outage
24 we will perform FAC inspections. That's the way the
25 procedure is written.

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1 JUDGE WARDWELL: Where is that written?
2 If it's the same answer you're going to give us that
3 you gave us for the discussion we had of the aging
4 management plan, we'll assume that --

5 JUDGE KARLIN: Don't get him started.

6 JUDGE WARDWELL: Yes. Don't get this --

7 (Laughter.)

8 We understand where it is --

9 JUDGE KARLIN: I woke up.

10 JUDGE WARDWELL: I know. We got him
11 excited now.

12 (Laughter.)

13 We had him sleeping and it was going fine.
14 We started pulling out books; we're in trouble.

15 (Laughter.)

16 If it is where you have alleged other
17 technical details are associated with our discussions
18 earlier this morning, I think we are familiar where it
19 is and where it is not.

20 MR. FITZPATRICK: Yes, it's through the
21 inspections, program procedure.

22 JUDGE WARDWELL: I think I'll start off
23 with Dr. Hausler again, and then move to Dr.
24 Hopenfeld. What is your justification for saying that
25 15 years of data is needed to benchmark CHECWORKS?

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1 What is the basis of that? I was going to start with
2 Dr. Hausler.

3 DR. HAUSLER: Well, basically, the
4 justification is this, that there are a large number
5 of points that have to be measured. They cannot all
6 be measured at one outage. They have to be measured
7 in succession.

8 And in order to determine the wear rate,
9 which is really not just used to select the points
10 where you are going to make your next measurement;
11 but, in fact, predict at what point in time a
12 particular item is going to be -- the wall thickness
13 of that particular item is going to be below curve.

14 In order to do that, you -- I'm sorry. In
15 order to do that, you would have to have fairly
16 accurate wear rates -- in such a way that you can
17 project when you need to either reexamine that
18 particular tank, or in fact to -- when you need to
19 replace it.

20 And in order to get reasonably accurate
21 forecasts, my estimation was that you would have to
22 have at least three data points to get yourself in the
23 direction -- to get the line -- three to at least be
24 able to not only calculate the slope but perhaps, you
25 know, put a confidence rate on that slope. So that's

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1 three.

2 You would have to -- if you do one-third
3 update measuring points of each outage, you have to
4 go, you know, nine times 1.5 years. You know, it
5 comes up to -- what -- 12, 14, 15 years, something
6 like that. That was the calculation, basically.

7 JUDGE WARDWELL: Mr. Fitzpatrick, it is
8 correct that you aren't measuring every point every
9 time?

10 MR. FITZPATRICK: Yes, sir.

11 JUDGE WARDWELL: In your four and a half
12 years of data, which is three -- three sets of
13 inspections, correct?

14 MR. FITZPATRICK: Yes, sir.

15 JUDGE WARDWELL: That means you are
16 getting one measurement from each point.

17 MR. FITZPATRICK: Some will be two, others
18 will be one. We are going to inspect some of the
19 components that we inspected this last outage on the
20 power uprate conditions and get another data point in
21 the power uprate measurement. So we have a
22 significant database of inspection data prior to power
23 uprate, and we'll be comparing post-power uprates
24 inspection data with the pre-power uprate inspection
25 data to see if there's any changes.

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1 JUDGE WARDWELL: But you should see
2 changes in your wear rate, I don't know what you call
3 that.

4 MR. FITZPATRICK: For the feedwater and
5 condensate system, we aren't detecting wear -- it's
6 within the band of the UT, so you're -- we use a
7 default 005.

8 JUDGE WARDWELL: But it really doesn't
9 matter whether you're detecting it or aren't. The
10 point is, with one data point, you have no indications
11 if that is the accurate, correct rate for a given
12 point.

13 MR. FITZPATRICK: We have more than one
14 data point because we have a pre- data point. We have
15 at least two data points.

16 JUDGE WARDWELL: You're got more than
17 that, but they are all taking place at a previous
18 power rate. I'm interested in --

19 MR. FITZPATRICK: And if you --

20 JUDGE WARDWELL: It's a question of
21 whether or not you don't need more -- how much
22 information you need to assure yourself that you've
23 got a good indication of what the power uprate is
24 doing to the flow accelerated corrosion.

25 MR. FITZPATRICK: We'll have an absolute

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1 measure of the differences in thickness from plant A
2 to plant B.

3 JUDGE WARDWELL: Right.

4 MR. FITZPATRICK: And that -- we can make
5 some assessment. If we start to see any real wear,
6 we'll increase the inspection scope for the procedure
7 and increase the number of inspections and the
8 frequency. But right now we don't have the data to
9 say we should do that.

10 JUDGE WARDWELL: But there are some points
11 now that you measured -- how many months into the
12 power uprate was your last inspection?

13 MR. FITZPATRICK: Twelve months.

14 JUDGE WARDWELL: Twelve months. That you
15 will never measure again until you go to the extended
16 period of operation, is that correct?

17 MR. FITZPATRICK: Yes. And there will be
18 others that have two points in the period. But if
19 you've got --

20 JUDGE WARDWELL: That doesn't impress me.
21 If you think that impresses me, it doesn't, because
22 when I plot off things, Dr. Hausler's explanation is
23 more consistent with what I use before I start making
24 engineering judgments, and that is, gee, I need a
25 minimum of three, because I can always put a straight

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1 line between two points. That's not a problem.

2 MR. FITZPATRICK: We have a pre-
3 established wear rate for a number of components based
4 on multiple inspection data prior to power uprate.

5 JUDGE WARDWELL: Fine. I want to know
6 what happens after power uprate.

7 MR. FITZPATRICK: Right now, all of the
8 wear rates that we are using for data selection, we
9 increase those calculated error rates 25 percent. All
10 of our planning is based on a 25 percent increase in
11 actual measured wear.

12 JUDGE KARLIN: Isn't that an assumption of
13 the proportionality almost?

14 MR. FITZPATRICK: Yes.

15 JUDGE KARLIN: Well, is it 25 percent
16 that --

17 MR. FITZPATRICK: It's proportional to
18 the --

19 JUDGE KARLIN: That's an assumption.

20 MR. FITZPATRICK: Yes.

21 JUDGE KARLIN: We're looking for data.

22 MR. FITZPATRICK: And we are taking the
23 data that will verify this subsequent. Right now, we
24 still have -- what I'm seeing is zero wear based on
25 one data point. We'll have another data point in the

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1 fall.

2 JUDGE WARDWELL: Not for all, just other
3 components.

4 MR. FITZPATRICK: Yes.

5 JUDGE WARDWELL: So how do you know that
6 the one measurement you made -- was it January of '07?

7 MR. FITZPATRICK: That's why we increased
8 the number of inspections 50 percent, at least for the
9 first three outages, just to get an established wear
10 rate. That's -- we're talking trending real data, not
11 CHECWORKS. This is --

12 JUDGE WARDWELL: Right. Nothing to do
13 with CHECWORKS. This is strictly, just as Judge Reed
14 said, pretend you threw out CHECWORKS. For your aging
15 management program, in order to establish that, for
16 the power uprate I don't see how you can do it on one
17 data point.

18 MR. FITZPATRICK: If you have one outage,
19 you can get one data point. Regarding -- even before
20 we do power uprate, we are -- we are assuming there is
21 a 25 percent increase in wear due to the power uprate,
22 and we're planning on that that -- we're proceeding to
23 make inspections at the location and frequency that is
24 based on the 25 percent increase right now.

25 JUDGE WARDWELL: Dr. Hausler?

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1 DR. HAUSLER: Thank you, Your Honor. I
2 would like to make a point. We just heard that every
3 point is in fact measured every outage -- every
4 outage. I would like to --

5 JUDGE WARDWELL: I'm sorry. What did you
6 just say?

7 DR. HAUSLER: Didn't Mr. Fitzpatrick just
8 say that every point is measured in fact at every
9 outage?

10 JUDGE WARDWELL: No, I don't believe he
11 said that at all. He said just the opposite. I mean,
12 he said that some may be measured twice over -- prior
13 to the extended period of operation. But a large
14 number will have only been measured once. Some of
15 them will only have been measured one time 12 months
16 after the power uprate. Others will be measured only
17 one time two and a half years after. And some will be
18 measured only once four years afterwards.

19 DR. HAUSLER: I'm sorry. It's late in the
20 afternoon. I must have misunderstood.

21 The other comment I wanted to make, if you
22 were indulge me just a second, is that we've heard the
23 comment against that localized flow-induced
24 accelerated corrosion is proportional to the velocity.
25 That is for fully developed, undisturbed turbulent

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1 flow. If you have a disturbance in that flow, then
2 that correlation is not correct anymore, and that has
3 been shown in fact by many people, including our --
4 you know, the Dechema studies in Germany. So I think
5 we have to be very careful in using that kind of, you
6 know, correlation.

7 JUDGE WARDWELL: Dr. Horowitz, did you
8 testify earlier that the effects of potential
9 turbulence is incorporated into your model? And in
10 what aspect?

11 DR. HOROWITZ: In the geometry factors.

12 JUDGE WARDWELL: Thank you.

13 Dr. Hopenfeld, why do you -- what is your
14 basis, specific basis, that led you to believe 15
15 years of data is needed at the power uprate?

16 DR. HOPENFELD: Until an hour ago, I had
17 two -- I had -- an hour ago I had two reasons. Now I
18 have four reasons. So the first one --

19 JUDGE WARDWELL: And your reasons are a
20 function of time.

21 (Laughter.)

22 DR. HOPENFELD: I have prepared a matrix,
23 as I said before, based on four groups, and I told you
24 those groups are identified first by some component of
25 safety. And then, there are -- the grid on all of

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1 them is one inch, and that takes care of all of the
2 uncertainty, all the uncertainties, on all of the
3 discussions about turbulence and discontinuities, and
4 so forth.

5 Now, as I understand, to some degree they
6 have a blanket system. I don't know. I'm going by
7 what's been said. They are already looking for
8 smaller grids that you would have that we specified in
9 that way. And the reason we want to go to a smaller
10 grid, the --

11 JUDGE WARDWELL: Dr. Hopenfeld, I am
12 begging you to answer the question.

13 DR. HOPENFELD: I'm just telling you --

14 JUDGE WARDWELL: The question had nothing
15 to do with the grid size. The question -- had 15
16 years of data, you said early on as part of your
17 original contention, needed to benchmark.

18 DR. HOPENFELD: That's correct.

19 JUDGE WARDWELL: I'm asking you if you
20 could explain why the -- what is the basis -- the
21 technical basis for you selecting 15 years. Dr..
22 Hausler was very specific. I would like to have the
23 same specificity from you if I possibly could.

24 DR. HOPENFELD: To cover the matrix and the
25 eight inspections -- eight inspections with about a

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1 year and a half for the first inspection. That's all.

2 JUDGE WARDWELL: Thank you.

3 DR. HOPENFELD: You want the other answer?

4 JUDGE WARDWELL: No, if you've got another
5 answer, you've got another one.

6 DR. HOPENFELD: I've got three.

7 JUDGE WARDWELL: Yes, give me the other
8 three quickly.

9 DR. HOPENFELD: The other ones are based
10 on judgment. All of the major problems we have -- not
11 any big ones -- Surry, the Japanese accident several
12 years ago, the major ones, not really accident, but
13 really significant -- where we were over 15 to maybe
14 28, 30 years. And if that's the time scale, things
15 are going under and this is a slow process.

16 So this is the time scale that we talked
17 about, a year? Some of them it may be 10. It's an
18 average. But it's a ballpark number, and it also
19 tells you, look, they have been looking. I mean, they
20 have been -- people didn't stop looking --

21 JUDGE WARDWELL: Great. That's the second
22 one. Good one. Third one?

23 DR. HOPENFELD: -- they've been looking
24 for year.

25 JUDGE WARDWELL: Now the third one.

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1 DR. HOPENFELD: The third one? It was
2 testified by -- I believe it's the first time I agree
3 with you -- that we could get away with CHECWORKS and
4 still be here today.

5 JUDGE WARDWELL: Thank you..

6 JUDGE REED: I would like to ask a couple
7 of questions, please.

8 JUDGE KARLIN: Sure.

9 JUDGE REED: It has been my impression
10 throughout this proceeding that the rate of corrosion,
11 flow accelerated corrosion, is essentially constant in
12 time. Whatever it is at a point, as long as the
13 reactor conditions don't change, the corrosion rate is
14 a corrosion rate and it corrodes essentially at a
15 constant rate. Is that wrong? Well, let me ask Dr.
16 Horowitz.

17 DR. HOROWITZ: If the water chemistry is
18 the same?

19 JUDGE REED: Yes, everything is the same.

20 DR. HOROWITZ: Yes, they would be
21 constant.

22 JUDGE REED: This is constant. So in
23 order to determine -- in order to determine that rate,
24 it really only takes two points. Is that correct?

25 DR. HOROWITZ: Yes.

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1 JUDGE REED: Okay. Now --

2 JUDGE WARDWELL: Can we ask, Dr.
3 Hopenfeld, do you agree with that?

4 DR. HOPENFELD: No. Because I --

5 JUDGE WARDWELL: Okay. That's all. You
6 don't have to do that.

7 JUDGE REED: Okay. Let me ask the staff
8 of the NRC. Do you agree that corrosion rates are
9 essentially constant given constant conditions? That
10 the conditions don't change, the rate at which the
11 metal corrodes is constant?

12 MR. HSU: Yes.

13 JUDGE REED: So basically the wall
14 thickness is basically reduced at a constant rate
15 until it's gone.

16 MR. HSU: That's right. Otherwise, you
17 cannot do any kind of testing. Your testing becomes
18 like useless, because it's going to keep changing.
19 Like in the testing data we have never really seen
20 this kind of development there.

21 JUDGE REED: Do Hausler, do you agree?

22 DR. HAUSLER: It's patently wrong.

23 JUDGE REED: Patently wrong?

24 DR. HAUSLER: That's correct. I believe
25 you made the -- you know, the answer already in part

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1 is in the question. The conditions do not remain the
2 same.

3 JUDGE REED: Oh, no, no. I'm sorry. I
4 asked you --

5 DR. HAUSLER: Let me explain what I mean
6 by that, please. The temperature, the pressures, the
7 environmental conditions remain the same. However,
8 the surface changes. As the surface changes, the
9 turbulence changes, and thereby the mass transfer. So
10 it is absolutely impossible that the corrosion rate
11 remains the same.

12 JUDGE REED: Is there any experimental
13 evidence to support this linear assumption, a constant
14 rate assumption? Dr. Horowitz?

15 DR. HOROWITZ: Tremendous number,
16 including some -- in Dr. Hopenfeld's written
17 statement.

18 JUDGE REED: And could you provide a
19 citation for us?

20 DR. HOROWITZ: Sure. NEC JH-72.

21 JUDGE REED: We don't need to take the
22 time to look them up. I'd just like to know what they
23 are.

24 JUDGE KARLIN: No, no, may I just ask a
25 question?

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1 JUDGE REED: Certainly.

2 JUDGE KARLIN: I mean, it seemed like Dr.
3 Hausler's point was a valid one, in that there is
4 something that doesn't -- the situation does not
5 remain the same, because the corrosion that is
6 occurring over time necessarily changes the thickness
7 of the pipe. So that is a variation. Does he have a
8 point there, Dr. Horowitz?

9 DR. HOROWITZ: Let me address your point
10 and his point.

11 JUDGE KARLIN: Yes, sir.

12 DR. HOROWITZ: Okay. Your point, first,
13 is correct that that's a very small variation. When
14 you have a large pipe, the area flow rate doesn't
15 change that much.

16 JUDGE KARLIN: All right.

17 DR. HOROWITZ: As far as the changing
18 conditions, I mentioned at least once in this
19 testimony Dr. Bryan Poulson. Bryan is a corrosion
20 metallurgist who specializes in mass transfer.

21 JUDGE KARLIN: He is a what?

22 DR. HOROWITZ: He specializes in mass --

23 JUDGE KARLIN: He is a --

24 DR. HOROWITZ: A corrosion metallurgist.

25 JUDGE KARLIN: What is that word?

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1 DR. HOROWITZ: Corrosion.

2 JUDGE KARLIN: Corrosion. I'm sorry,
3 corrosion.

4 DR. HOROWITZ: Corrosion metallurgist who
5 specializes in mass transfer.

6 JUDGE KARLIN: Okay.

7 DR. HOROWITZ: And we used to have
8 discussions with him about this third issue, about how
9 -- factoring the change over times with the roughening
10 of the surface. Okay. That sounds good. Bryan did
11 some experiments with copper, and he also wrote some
12 papers based on the data.

13 With copper, the surface roughens more
14 than steel. You do see that impact, but only in small
15 sizes. But the more interesting thing he has done is
16 he has correlated mass transfer coefficient as a
17 function of flow conditions, including roughness. And
18 he came to the surprising conclusion -- it was
19 surprising to him -- that once a surface is rough, it
20 doesn't matter anymore how rough it gets. And that
21 was as surprising to him as it was to me.

22 So, number one, he disagreed that you
23 start with the surface, it gets rough, the coefficient
24 -- the corrosion rate changes, and you keeps changing
25 for ever and ever. I don't think that's true based on

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1 Bryan's results.

2 Secondly, looking at a lot of pipes
3 that --

4 JUDGE REED: I'm sorry. Let me interrupt
5 you. Would your point be that, since this reactor has
6 been operating for 30-some years, the surface is about
7 as rough as it's going to get --

8 DR. HOROWITZ: Yes.

9 JUDGE REED: Now -- and so there's not
10 going to be an effective change in the roughness for
11 the next 20 years.

12 DR. HOROWITZ: Right.

13 JUDGE REED: All right. Thank you.

14 DR. HOROWITZ: The surface is a steady-
15 state common condition.

16 JUDGE REED: Well, I wonder if that
17 wouldn't imply, if you really believe that the
18 corrosion rate is a constant, instead of being
19 assessed with points to validate a code under
20 CHECWORKS, wouldn't it be better once you got a couple
21 of data points, or the points that you're examining
22 with -- as a result of the recommendations out of
23 CHECWORKS, to -- would it profit us to look elsewhere
24 in the reactor system for other places where corrosion
25 might occur, rather than continuing to look for 15

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1 years at the same old places and verify this linear
2 assumption with five or six data points on a straight
3 line? That is a question for Dr. Horowitz.

4 DR. HOROWITZ: Okay. That's a very good
5 point. Once you have a lot of data, and your
6 conditions are the same, CHECWORKS doesn't really add
7 a whole lot of value. CHECWORKS adds value when
8 conditions are changing, you want to forecast what
9 impact it has on corrosion.

10 NSAC-202 recommends basically that
11 procedure. It says, "When you look at the list of
12 inspections, we do inspections, about half should be
13 new locations, and about half should be old
14 locations." That's the rule of thumb. But that is,
15 clearly, the guidance we have seen talking to a lot of
16 people throughout the industry.

17 JUDGE REED: Okay. Thank you. That's
18 all.

19 JUDGE WARDWELL: Mr. Fitzpatrick, in your
20 testimony -- you don't need to refer to it -- I think
21 you'll agree that at A-43, page 27, or somewhere near
22 there -- I think that's correct, that it's there --
23 but at some point in your testimony I believe that's
24 the one you discussed Vermont Yankee's operational
25 experience and how useful that is in correlating

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1 CHECWORKS with maybe your flow accelerated corrosion
2 program.

3 While you do have a lot of experience at
4 Vermont Yankee, your experience under the current
5 power uprate is pretty limited, isn't it?

6 MR. FITZPATRICK: Once cycle, yes.

7 JUDGE WARDWELL: Yes. So you don't have
8 much under this -- these conditions, correct?

9 MR. FITZPATRICK: Yes.

10 JUDGE WARDWELL: Have you studied the
11 results of flow accelerated corrossions from other
12 plants that have been operating for longer periods of
13 time at the powers that -- power level that you
14 currently are at?

15 MR. FITZPATRICK: I have looked at studies
16 from other plants, the CHECWORKS studies, and saw
17 increases proportional to velocity. That's what we
18 based our 25 percent number one. They had smaller
19 power uprates, and they --

20 JUDGE WARDWELL: Do you know about what
21 their absolute level of power is? Because, again, you
22 agree that it's not necessarily the percentage of
23 increase, it's where you end up at the power level
24 that's critical. You could have a 90 percent increase
25 if you start off real low and ended up at 500

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1 megawatts of power, and you would have --

2 MR. FITZPATRICK: If there's a big BWR,
3 I'd be -- 400-something megawatts electric.

4 JUDGE WARDWELL: So much larger than what
5 you are --

6 MR. FITZPATRICK: Yes.

7 JUDGE WARDWELL: So a much higher power
8 level.

9 MR. FITZPATRICK: Yes.

10 JUDGE WARDWELL: Thank you.

11 Dr. Horowitz, you reviewed a lot of
12 different pipe failures from various other plants.
13 And, miraculously, you were able to attribute all of
14 the ruptures to something other than CHECWORKS.

15 DR. HOROWITZ: Yes.

16 JUDGE WARDWELL: Some of those related to
17 the effectiveness of it at non-U.S. plants. Others I
18 believe were related to inappropriate application of
19 CHECWORKS by the operator at the plants. Were there
20 any other types of reasons for these unanticipated
21 ruptures to have occurred, that you can remember off
22 the top of your head that I can't?

23 DR. HOROWITZ: First of all, I was the one
24 who characterized the causes of failures. I think
25 you're talking about Fort Calhoun in particular, and

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1 Millstone 3 in particular. It was the NRC who
2 characterized it, not me.

3 JUDGE WARDWELL: Okay. Thank you.

4 DR. HOROWITZ: I can't think of a foreign
5 plant that had a failure using CHECWORKS or PAN. If
6 you're referring to Mihama in Japan three years ago,
7 or four years ago, that was nothing to do with
8 CHECWORKS, nothing to do with BENSAC. They have their
9 own way of doing business, and it's completely
10 different than we have.

11 I think for all the plants -- the ones
12 that were discussed here in testimony --

13 JUDGE WARDWELL: And there were some in
14 there that you or someone else attributed to modeling
15 errors, is that correct?

16 DR. HOROWITZ: Fort Calhoun is the only
17 one that leaps to mind. Millstone 3 was a modeling
18 error in that lines were omitted from the analysis.

19 JUDGE WARDWELL: I think there were some
20 modeling difficulties associated with the time
21 tracking of the model was one of the ones I had, but
22 that's fine.

23 I guess my point here is: is there
24 something inherently difficult in the model to apply
25 it that the errors occur? Or are these in fact --

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1 DR. HOROWITZ: I think, in fairness --
2 I'll put my EPRI hat on -- EPRI bears some of the
3 blame for that trend. EPRI has beefed up its training
4 in the last several years. And as time goes by, they
5 do training again and again, and we learn from each
6 one, and we try and make the software as easy to use
7 as possible in each of our training.

8 The other side is it's a lot of
9 information that has to be put in by an engineer, and
10 it should be checked by an engineer. The common -- I
11 don't see any common mistake that people are making
12 is, "Well, here's the wrong components code for this
13 situation." Fort Calhoun is one thing, Millstone 3
14 was something else, so I -- you know, I don't see how
15 we can fix the problems until we better understand
16 what's causing them.

17 JUDGE WARDWELL: All right. Thank you.

18 Mr. Fitzpatrick, when you make a
19 measurement, that's -- the measurement you're making
20 is of the wall thickness. That is a result of total
21 thinning, or the --

22 MR. FITZPATRICK: It's basically the
23 condition of the pipe at the time of the measure.

24 JUDGE WARDWELL: What's the thickness of
25 the wall.

1 MR. FITZPATRICK: Yes.

2 JUDGE WARDWELL: That's what you're
3 measuring.

4 MR. FITZPATRICK: Yes, sir.

5 JUDGE WARDWELL: And, again, I think we
6 discussed this earlier this morning -- that thickness
7 in the wall is what it is, and it's a result of
8 whatever phenomena is occurring in that pipe, whether
9 it's flow accelerated corrosion, droplet impingement,
10 cavitation, erosion -- the whole enchilada. Whatever
11 that result, it's a global measurement effect, right?
12 And with no discrimination between the causal effects
13 or resulting in the thickness that it happened to be
14 at that given time, correct?

15 MR. FITZPATRICK: Yes, sir.

16 JUDGE WARDWELL: Dr. Horowitz, when that
17 is incorporated into CHECWORKS, CHECWORKS pretends
18 that is all flow accelerated corrosion, doesn't it?

19 DR. HOROWITZ: That's right.

20 JUDGE WARDWELL: There's a dichotomy
21 there. I mean, it's --

22 DR. HOROWITZ: That's true, and we
23 understand that. We only see the way -- the saving
24 grace as it were, in the fact that all of the studies
25 I've seen say that flow accelerated corrosion is by

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1 far the predominant degradation mechanism in the
2 systems.

3 The other point I can make, and sometimes
4 comes into play, is if you have impingement in
5 particular and you make measurements on a grid. The
6 wear pattern for impingement is fairly different. The
7 wear is much more localized, and an experienced
8 engineer can recognize the difference. That doesn't
9 happen all the time, but it happens with some of them.
10 So it's not quite as bad a situation as you may think.

11 JUDGE WARDWELL: When you run the pass-to
12 of the program, and it tries now to apply this linear
13 correction factor to the results, the first time you
14 do that pass-to -- strike that last statement. The
15 magnitude of the linear correction factor is
16 influenced, isn't it, by those other phenomenon, if in
17 fact it were occurring at that particular location?

18 DR. HOROWITZ: That's certainly true. In
19 general, though, if you're measuring, say, five
20 components in the line, you wouldn't -- no, I think
21 it's very unlikely that you'd have five components
22 damaged by other mechanisms in FAC.

23 JUDGE WARDWELL: So that line correction
24 factor is just what it says. It's for the whole
25 string, not for the individual components.

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1 DR. HOROWITZ: That's correct.

2 JUDGE WARDWELL: Thank you.

3 Dr. Hausler, do you agree that droplet
4 impingement produces a different type of wall thinning
5 pattern than flow accelerated corrosion does?

6 DR. HAUSLER: Well, the morphology of the
7 -- patterns as you called them, is very likely
8 different, yes, indeed. The mechanism, however, I
9 think is essentially the same. If you have a droplet
10 impinge on the surface, the -- whatever is between the
11 droplet and the surface is being squeezed out. That
12 squeezing mechanism generates very high velocities,
13 and, in fact, you know, sort of like a suction in the
14 sense that now the droplet is, you know, almost sucked
15 into the surface so to speak.

16 At that point, you have locally extremely
17 high shear stress, and, therefore, very high mass
18 transfer. And that, of course, causes the -- you
19 know, the corrosion to be sort of localized. Now, if
20 that droplet always hits the same point, then you will
21 get kind of a trough. If that droplet, however, hits
22 the surface randomly -- I mean, if droplets hit the
23 surface randomly, you may well see in the end a larger
24 trough with kind of orange peel surface maybe. No,
25 actually, it's more like perhaps a golf ball type of

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1 surface.

2 JUDGE WARDWELL: If, in fact, the droplet
3 stayed in one position, would it do what was alleged
4 by I think it was Entergy that you would get a hole,
5 and that hole would not tend to grow?

6 DR. HAUSLER: No. I think if a droplet
7 hits the surface it cannot possibly stay in the same
8 position. Did I misunderstand the question?

9 JUDGE WARDWELL: If it did, if it kept
10 hitting the same location, would it not make a hole
11 and then --

12 DR. HAUSLER: If successive droplets hit
13 the same location --

14 JUDGE WARDWELL: Right, yes.

15 DR. HAUSLER: -- constantly, yes, you will
16 get in fact -- you know, that's like a drill. You
17 know, you can go through a wall, you know, like
18 drilling.

19 JUDGE WARDWELL: Dr. Horowitz, I think it
20 was you that testified about the droplet. What leads
21 you to believe the droplet would hit the same location
22 all the time and not hit other locations? Just keep
23 on sweeping back and forth and eventually wear it very
24 similar to what flow accelerated corrosion would?

25 DR. HOROWITZ: Thank you for asking me

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1 that. There is numerous experience showing pinhole
2 leaks, particularly heater vent lines where you have
3 exactly this phenomenon occurring. You have one hole
4 or maybe one or two little holes, and it looks like
5 somebody took the drill and broke through that pipe
6 hole.

7 JUDGE WARDWELL: In that same experience,
8 recorded experience, documented experience, was there
9 any indication that it tended to migrate and, in fact,
10 would create a larger area of failure than just a
11 pinhole?

12 DR. HOROWITZ: "Larger" is relatively most
13 failures -- most failures of the pressure boundaries
14 like that are under an inch or -- or probably mostly
15 under average.

16 JUDGE WARDWELL: I'm sorry. Mostly?

17 DR. HOROWITZ: Well, it would be around an
18 inch. Most of the ones would be under a half an inch.

19 For example, let me give you --

20 JUDGE WARDWELL: I'm sorry. I think
21 you're answering the wrong -- I didn't make myself
22 clear in regards to my question. My question was: at
23 those documented -- the documentation that you just
24 said from the plethora of experience you say there is
25 with this droplet impingement producing a hole, was

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1 there any indication that at some of the locations the
2 droplet did not hit the same location, but in fact
3 migrated at various other locations nearby, so that it
4 produced a larger non-circular type of failure, like
5 a crack, a broader-based crack, the wall thinning over
6 a larger area, so that you ended up with a breach --
7 a crack, a breach in one -- in a line as opposed to a
8 circle here.

9 DR. HOROWITZ: The experience varies
10 actually. In general you have pinholes and slightly
11 larger holes, perhaps a quarter inch, perhaps a half
12 inch. Occasionally, you'll see something that looks
13 a little different, and it's more of a challenge.

14 But if you look, for example -- and Mr.
15 Witte referred to one of the scoping reports, and
16 there is some experience listed, and in that they talk
17 about pinhole leaks and holes in vent lines. Those
18 are in the category of small -- small leaks I think is
19 the way it was characterized.

20 JUDGE WARDWELL: Thank you.

21 Dr. Hausler, could you clarify for the
22 Board what was the basis for concluding that the
23 accuracy of CHECWORKS is within two? I think that was
24 part of your testimony on page 3 of RH-04.

25 DR. HAUSLER: Yes. We looked a little

1 earlier at one of those graphs that shows the diagonal
2 for the prediction of the measured wear on the break.
3 And we saw two lines -- one is 50 percent, the other
4 one 50 percent on the lower end.

5 Now, if you look -- if you think about
6 what the 50 percent means, it's that the prediction is
7 50 percent of what you find. That is not the focus or
8 the objective of what is being done. We would like to
9 know how accurate the measurement is with respect to
10 the prediction.

11 If you go back and look at these curves
12 you will find that the 50 percent line is actually a
13 factor of two over the prediction. Similarly, the
14 minus 50 percent line, if you look at it again, you
15 will find it is half of the prediction -- again, a
16 factor of two.

17 If you permit me to comment, it is nice to
18 have 50 percent accuracy in corrosion, because that
19 would be, you know, quite tolerable. It is not so
20 nice to have an accuracy of a factor of two in
21 corrosion, because that puts into question the -- you
22 know, the prediction of what is going to happen in the
23 future. In other words, you cannot really, you know,
24 predict when the wall is being thinned to the point,
25 just like Dr. Hopfenfeld said, to the point where, you

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1 know, you are below code.

2 That is the basis for my -- for my
3 comment. Perhaps it's -- you know, it's --

4 JUDGE WARDWELL: Well, it's basically,
5 you're taking the inverse of the 50 percent, and that
6 is where the two factors sort of basically comes up.
7 And it's a communication tool to put a handle of how,
8 as you say, accurate --

9 DR. HOROWITZ: And I --

10 JUDGE WARDWELL: And you're saying, aren't
11 you, that it's better to word it that it's a factor of
12 two, rather than 50 percent accuracy, and it better
13 represents your ability to predict something.

14 DR. HOROWITZ: I think it's a matter of
15 logic as well.

16 JUDGE WARDWELL: That's fine.

17 DR. HOROWITZ: Because, you know, you can
18 cite on the one side the prediction. The prediction
19 is 50 percent of what we see. On the other side,
20 towards the lower values, we would say the prediction
21 is -- what we see is 50 percent of the prediction.

22 And so, you know, you shift the argument
23 depending on which side of the curve you look at. And
24 the way I'm trying to explain it is a lot more
25 consistent, because on the high side we've got a

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1 factor of two, and on the lower side we've got a
2 factor of two as well.

3 And what you're really interested in is
4 not a prediction. What you are really -- is not, you
5 know, what the model tells you. What you are really
6 interested in is what actually happens in the field --
7 in real life.

8 JUDGE WARDWELL: That's good. Thank you.
9 That helped a lot.

10 Your RH-03 -- and I was quickly trying to
11 look for it, and I -- I can't place my fingers on it
12 right off the bat. I've got 04 and 05. I've got 01
13 and 02.

14 JUDGE KARLIN: RH-03.

15 JUDGE WARDWELL: It would appear I dreamt
16 it, except we have a gap also.

17 JUDGE KARLIN: I believe it's -- is it
18 testimony?

19 JUDGE WARDWELL: I assume it's a report.
20 There's a figure in there that I'm interested in
21 seeing where the data points came from.

22 MS. TYLER: We have it, Judge Karlin.

23 JUDGE KARLIN: Oh, okay.

24 JUDGE WARDWELL: Where is that bound?

25 MS. TYLER: It's in the big volume.

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1 JUDGE WARDWELL: Oh, okay. Oh, there it
2 is. Yes, it snuck in -- oh, tricky, yes, tucked right
3 in between JH-53 and UW-03.

4 JUDGE KARLIN: Okay.

5 JUDGE WARDWELL: Ah ha. I know it's not
6 me going senile. And it is a report discussing this
7 by him, and it's 8 of 12, I believe.

8 JUDGE KARLIN: It's a report by whom?

9 JUDGE WARDWELL: RH-03 at 8, and I think
10 it's slash 12. Let me see if I can find it again.
11 It's a report by Dr. Hausler, and it's Figure 3.
12 Okay. There we go. Okay. Figure 3.

13 DR. HAUSLER: What page?

14 JUDGE WARDWELL: It's 11 of 18. I've got
15 Figure 3, but -- bear with me for a minute. Well, I
16 must have been thinking about Figure 5, and I just
17 have it typed wrong, because that's the only figure
18 that has data points on it. That must be it, the mass
19 loss rate of Figure 5, 12 of 18. That's all I can
20 figure.

21 Where did those figures come from, and
22 what are the various data points? What are we varying
23 there?

24 DR. HAUSLER: Well, the data points are
25 the mass loss rate plotted versus the X over D. In

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1 other words, the distance and the relative distance
2 normalized to the diameter of the pipe.

3 JUDGE WARDWELL: Okay. So that's --
4 that's the plate orifice that you were talking about
5 earlier, that you referenced.

6 DR. HAUSLER: That's correct, yes.

7 JUDGE WARDWELL: The pipe and the orifice
8 you're representing is that figure up above.

9 DR. HAUSLER: Correct.

10 JUDGE WARDWELL: The top part is --

11 DR. HAUSLER: Correct.

12 JUDGE WARDWELL: Got you. But what are --
13 what I don't understand is, what are the various
14 lines? What is the triangle, the circle?

15 DR. HAUSLER: They are -- it's a function
16 of the parameters, velocity, meters per second. U
17 equals --

18 JUDGE WARDWELL: So that's velocity.

19 DR. HAUSLER: That's velocity.

20 JUDGE WARDWELL: Okay. So the different
21 lines of the graph are the velocity.

22 DR. HAUSLER: Different velocities, that's
23 correct.

24 JUDGE WARDWELL: And do you have a
25 reference for who did this work?

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1 DR. HAUSLER: Yes. The reference is
2 actually listed in the paper, in one of the footnotes.
3 That's -- it comes from a paper by Heitz and Durman.
4 It's --

5 JUDGE REED: Am I reading this correctly?
6 This particular --

7 DR. HAUSLER: It's Reference 8.

8 JUDGE REED: Pardon me. Am I reading this
9 correctly? This is not -- this is for stainless
10 steel, or it represents stainless steel?

11 DR. HAUSLER: That's correct.

12 JUDGE REED: And it also contains sand.

13 DR. HAUSLER: That's correct. The reason
14 why this graph is in here is to demonstrate that in
15 fact the corrosion -- in order to demonstrate the flow
16 path. And the flow path, you know, obviously carries
17 the sand at certain velocities. And, you know, where
18 the velocity is high -- in fact, in this case it was
19 abrasion. Not just erosion or corrosion, but
20 typically abrasion.

21 And what I wanted to demonstrate with this
22 is that, you know, a very high, you know, velocity can
23 be prior to the orifice. In other words, the
24 corrosion has not only happened after the orifice, but
25 it happens prior to the orifice as well.

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1 In other words, the flow pattern is such
2 that you can expect, even if you didn't have any, say,
3 high turbulence right ahead of the orifice as well as
4 after the orifice. And that has been observed not
5 just in this but with -- you know, in other systems as
6 well.

7 JUDGE REED: Okay. I take your point.
8 But I would like to ask Dr. Horowitz, did you think
9 this particular chart -- do you have it in front of
10 you? Does it have any relevance or applicability to
11 flow accelerated corrosion where we do them with
12 carbon steels and we don't have sand hopefully in
13 other reactor systems?

14 DR. HOROWITZ: I don't see the relevance
15 to flow accelerated corrosion.

16 JUDGE WARDWELL: What's your indication
17 that it doesn't have the same type of relationship?

18 DR. HOROWITZ: Well, Dr. Hausler is
19 correct you have flow pattern disturbance upstream of
20 the orifice. But, with direct flow missing, it's a
21 different mechanism. It's primarily erosion or some
22 particle erosion. And I don't think there is anybody
23 who is going to argue that if you had a geometry like
24 this, or any arbitrary geometry where the diameter is
25 changing, that the corrosion rate would vary along the

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1 top.

2 JUDGE WARDWELL: So you think it's more a
3 function of the geometry than it is the fact that this
4 is dealing with the mechanical erosion primarily as
5 opposed to a chemical erosion factor.

6 DR. HOROWITZ: Yes. I mean --

7 JUDGE WARDWELL: It really influences the
8 geometry. If you put pure water through it, you know,
9 you're able to measure the flow accelerated corrosion
10 associated with this -- not pure water, but the
11 reactor-type water, that would have the appropriate
12 chemicals to cause the melting of that, so flow
13 accelerated corrosion. That you might very well see
14 the effects downstream and initially upstream similar
15 to what has happened here for mechanical, but that you
16 don't have orifices like this in a plant.

17 DR. HOROWITZ: Not normally. You only see
18 this with carbon steel.

19 JUDGE WARDWELL: Thank you. I think
20 that's it. I'm done.

21 JUDGE KARLIN: Okay. I thank you. We
22 have completed our initial questions of the witness
23 panel on Contention Number 4. We will now take a
24 break, at which time we will go through our notes and
25 try to assess whether we may have some other questions

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1 we missed or want to ask.

2 We ask the parties to give us this --
3 their suggestions, if any. We are not encouraging it,
4 If you don't have any, that's fine, too. And maybe we
5 should take a break for, well, 20 minutes let's try.

6 JUDGE WARDWELL: Why don't we take a two-
7 phase break. We will -- you know, have them get it
8 into us by a certain time, and then give us that much
9 more extra time, because we always seem to go longer
10 every time we did this so far.

11 JUDGE KARLIN: Right. Right. I want
12 to --

13 JUDGE WARDWELL: We need at least 15
14 minutes to review all of it.

15 JUDGE KARLIN: Yes. I think we will ask
16 for you to get them to us in 10 minutes. Would that
17 be feasible? Entergy, are you okay with that? I
18 mean, maybe you've been working on them all along? I
19 don't know.

20 JUDGE WARDWELL: Knowing how busy you've
21 been at the various tables, I assume that there may
22 have been times --

23 JUDGE KARLIN: Try to get them to us in 10
24 or 15 minutes, and then we will let you know how much
25 more time it looks like it will take us to study them.

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1 We will stand adjourned now.

2 (Whereupon, the proceedings in the
3 foregoing matter went off the record at
4 3:50 p.m. and went back on the record at
5 4:31 p.m.)

6 JUDGE KARLIN: We will go back on the
7 record.

8 We are now at the finale of asking
9 questions with regard to contention #4. We have
10 received proposed written questions from Entergy, the
11 New England Coalition, the State of New Hampshire, and
12 from the staff, and we have thought about other
13 questions we might want to follow up with.

14 And I think Judge Wardwell will -

15 JUDGE WARDELL: Leap into the breach.

16 First the question for Entergy, we heard
17 from Dr. Horowitz that - and as I think is outlined in
18 NSAC-202L that CHECWORKS isn't good for pipelines
19 under two inches.

20 Does NSAC-202L provide inspection
21 recommendations for pipelines less than two inches in
22 diameter, Mr. Fitzpatrick?

23 MR. FITZPATRICK: Yes. NSAC-202L has a
24 recommendation for small bore pipes.

25 JUDGE WARDELL: So that's specified within

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1 here, what that program should be?

2 MR. FITZPATRICK: Yes.

3 JUDGE WARDELL: In a more general sense you
4 have been testifying here, are you currently an
5 employee of Vermont Yankee?

6 MR. FITZPATRICK: No, I left there in
7 March.

8 JUDGE WARDELL: Are you an employee of
9 Entergy?

10 MR. FITZPATRICK: No.

11 JUDGE WARDELL: I remember at one point you
12 did use the phrase, we, and I think you have been
13 representing Entergy here.

14 Have you been authorized to make
15 statements on their behalf? And authorized to express
16 what that company intends to do?

17 MR. FITZPATRICK: I believe so.

18 JUDGE KARLIN: Have you been authorized to
19 commit - you say, we are going to do this. We are
20 going to do that. Does that mean you are authorized
21 to commit here under oath that Entergy is going to do
22 those things for the period of extended operation?

23 MR. FITZPATRICK: Entergy has already
24 committed to do those things, by the licensing
25 process.

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1 JUDGE KARLIN: Okay, so there is some - we
2 are not going to get into that again.

3 (Laughter)

4 JUDGE WARDELL: We don't have half a day
5 left here.

6 Dr. Horowitz, how often do you recommend
7 a plan update CHECWORKS for optimal use?

8 DR. HOROWITZ: I personally recommend after
9 every outage NSAC-202L is a little slippery on the
10 subject, it's when convenient, whatever that means.

11 JUDGE WARDELL: I'm sorry?

12 DR. HOROWITZ: Something to the effect that
13 it is recommended to be done when convenient without
14 really defining what that means.

15 JUDGE WARDELL: But what do you feel in
16 your professional opinion should be done?

17 DR. HOROWITZ: After every outage.

18 JUDGE WARDELL: And how soon? Personally.
19 Professionally and personally?

20 DR. HOROWITZ: Probably within 60 to 90
21 days.

22 JUDGE WARDELL: Within what? I'm sorry.

23 DR. HOROWITZ: Sixty to 90 days.

24 JUDGE WARDELL: Thank you.

25 Mr. Fitzpatrick, I think you had two

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1 different answers in regards to why the model wasn't
2 updated, what the inspection data wasn't incorporated
3 until close to the next refueling cycle.

4 You first said that you used the criteria
5 that if the inspection didn't show wear, then you used
6 the criteria of resource availability, or at least the
7 excuse rather than the criteria.

8 Which is it in regards to updating the
9 model?

10 MR. FITZPATRICK: Not updating the model is
11 resource availability. The only resource
12 availability, the model should be updated every cycle.

13 I wrote CRS because we were updating the
14 model, and identifying the management for the resource
15 - to get resources.

16 JUDGE WARDELL: So you wrote correction
17 action?

18 MR. FITZPATRICK: Correction action, yes.

19 JUDGE WARDELL: For what now?

20 MR. FITZPATRICK: Identifying when we
21 hadn't updated a model at two different points in
22 time.

23 JUDGE WARDELL: Within that refueling
24 period?

25 MR. FITZPATRICK: Well, there were two

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1 different outages.

2 JUDGE WARDELL: Oh, okay. How soon do you
3 write those?

4 MR. FITZPATRICK: When we start to realize
5 - or you know when we know we are getting along on the
6 time to do an updated model.

7 JUDGE WARDELL: Do you remember when you
8 did write them specifically for these two instances?

9 MR. FITZPATRICK: 2005, and 2006.

10 JUDGE WARDELL: For the inspections that
11 took place when?

12 MR. FITZPATRICK: Well, that was for the
13 models for inspections, 2004, 2005.

14 JUDGE WARDELL: So within the next year, it
15 hadn't occurred within how many months about then? Do
16 you think you wrote these?

17 MR. FITZPATRICK: I know the dates I wrote
18 them. The last one was written August, 2006.

19 JUDGE WARDELL: For an inspection that was
20 taken when?

21 MR. FITZPATRICK: Spring or fall, 2005.

22 JUDGE WARDELL: Well, big difference.

23 MR. FITZPATRICK: It does make a
24 difference. Fall of 2000, in the outage, spring.

25 JUDGE WARDELL: That's sufficient.

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1 At Vermont Yankee do you have any
2 instances of a pipe burst for which you have
3 correlated your data. Did the model predict it?

4 MR. FITZPATRICK: Pipe burst?

5 JUDGE WARDELL: Yeah, or failure.

6 MR. FITZPATRICK: The CHECWORKS model? No.

7 JUDGE WARDELL: Let's refer back to UW-07.

8 (Pause)

9 JUDGE KARLIN: While we're waiting maybe I
10 could ask that same question of Dr. Horowitz, which
11 is, I think, has there been a pipe burst against which
12 you have correlated your data? And did your model
13 predict it, CHECWORKS? Ever?

14 DR. HOROWITZ: I think the answer is no.

15 JUDGE KARLIN: So there has never been a
16 pipe burst against which - at a facility that was
17 using CHECWORKS?

18 DR. HOROWITZ: That's correct. That's a
19 little of - are you using CHECWORKS?

20 JUDGE KARLIN: Yes.

21 DR. HOROWITZ: Say it that way, I would say
22 Ft. Calhoun and 99, excuse me, not Ft. Calhoun,
23 Callaway and 99.

24 JUDGE KARLIN: All right, and so that was
25 a facility that was using CHECWORKS or its

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1 predecessor, and there was a pipe burst, yes?

2 DR. HOROWITZ: Yes.

3 JUDGE KARLIN: And did your model predict
4 it?

5 DR. HOROWITZ: No, not for that one.

6 JUDGE KARLIN: Why not?

7 DR. HOROWITZ: The conditions at Callaway
8 were very unusual compared to typical conditions
9 around the nuclear plants. There are only two plants
10 having similar lines. And that one failed, the sister
11 locations at Callaway and Wolf Creek, the sister
12 plant, some showed damage and some did not show
13 damage.

14 And so it seemed to be a case where the
15 flow regime was different enough that there was a
16 variability between locations.

17 JUDGE KARLIN: All right, thank you.

18 JUDGE WARDELL: Let me ask this, then.
19 Under UW-07, at page NEC 038428, the bottom row talks
20 about pipe replacements, unplanned and during cycle
21 errata.

22 What is that related to?

23 MR. FITZPATRICK: This is a standard form
24 that the program engineers fill out. It's an
25 assessment form, and this is the criteria they use.

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1 If your unplanned replacements, and you are finding
2 unexpected wear, or you have a leak and you have to do
3 a repair, you indicate the number - the number on the
4 chart, and that ranks you where you are, if you have -
5 this is a criteria for high. If you have zero or
6 three -

7 JUDGE WARDELL: Am I reading this correctly
8 that there was an unplanned pipe or component
9 replacement due to current outage finding?

10 MR. FITZPATRICK: I think there is a
11 mistake there, sir. It should be a zero. The note
12 says no outage this quarter, no unplanned piping
13 replacements in the operating cycle. And I wrote that
14 note on the leak on the small bore SS0 low point gray
15 line. That should be one, not two.

16 JUDGE WARDELL: Why is that one and not
17 two? Because you have done a replacement? You mean
18 it's a white criteria as opposed to a red?

19 MR. FITZPATRICK: Red would be more than
20 two. We identified one component.

21 JUDGE WARDELL: Oh, I see. I understand
22 now.

23 MR. FITZPATRICK: And that work order was
24 written about the same time.

25 JUDGE WARDELL: Isn't that a pipe leak? It

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1 may not be a rupture, but it's a leak, isn't it?

2 MR. FITZPATRICK: It's a leak in a small-
3 bore drain line through the elbow that connects the
4 condenser, operates at 4 psi, and one end is tracking
5 the other.

6 JUDGE WARDELL: And it is part of the FAC?

7 MR. FITZPATRICK: The concluding FAC
8 program and the small-bore product, yes, sir.

9 JUDGE WARDELL: And so, and so the NSAC
10 procedure that you followed for less than 2-inch
11 diameter pipes didn't work in this instance?

12 MR. FITZPATRICK: Didn't work? I wouldn't
13 characterize it like that. There was a leak in the
14 pipe. We had inspected for the condenser. We hadn't
15 inspected up at the other end of the pipe yet.

16 It was prioritized low because of the low
17 pressure and low consequence.

18 JUDGE WARDELL: And it was replaced during
19 this outage?

20 MR. FITZPATRICK: Yes it was replaced.

21 JUDGE WARDELL: Has the staff, EPRI, or any
22 other auditing group or peer review ever indicated any
23 weaknesses in the facts or potential for improvements
24 in your current fact program.

25 MR. FITZPATRICK: In the current fact

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1 program?

2 JUDGE WARDELL: Yes.

3 MR. FITZPATRICK: No, I think the program
4 is put together in the past two or three years, the
5 NNTC procedure, the EN procedure, was implemented
6 March, 2006.

7 JUDGE WARDELL: So at least in the last two
8 years the current backed program hasn't been audited
9 by anyone?

10 MR. FITZPATRICK: Other than a Q/A with
11 implementation audit at one of the sites. It's used
12 at all the Entergy sites, not at BY there wasn't.

13 JUDGE WARDELL: Did you have a FAC program
14 prior to the power uprate?

15 MR. FITZPATRICK: Yes.

16 JUDGE WARDELL: And was that ever indicated
17 to have any weaknesses by an audit from either staff,
18 EPRI, or any other -

19 MR. FITZPATRICK: Yes, an EPRI assessment
20 in '99, they gave recommendations. We've had NFC
21 audits, an NFC audit of 2005 prior to the power
22 uprate. They spent a week looking into programs.
23 And their recommendation was, get the - they were
24 really concerned about getting CHECWORKS models
25 completed on time. EPRI and NRC feels the predictive

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1 elements of the program are important and should be
2 used the way it's recommended it be used. And that's
3 why we wrote a CR.

4 JUDGE WARDELL: Thank you.

5 Staff, is that consistent with your
6 understanding of the audits and comments that have
7 been made with regard to the past FAC programs at
8 Vermont Yankee?

9 MR. ROWLEY: It's my understanding that
10 that was done for power uprates, that they essentially
11 look at the program.

12 JUDGE WARDELL: And do you know of any
13 other audits or comments from either EPRI or yourself
14 that have critiqued the previous FAC?

15 MR. ROWLEY: Mr. Horowitz himself did a
16 critique -

17 JUDGE WARDELL: Sorry?

18 MR. ROWLEY: Mr. Horowitz himself had did
19 a critique of their program not too long ago in the
20 past three or four years.

21 JUDGE WARDELL: Of the items identified
22 that were questionable, did Mr. Fitzpatrick
23 characterize the ones that you are familiar with?

24 MR. ROWLEY: Repeat. I'm not sure I
25 understand the question.

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1 JUDGE WARDELL: Well, he identified some
2 deficiencies that were noted in a previous audit from
3 either yourselves, EPRI, or some other auditing
4 organization in his previous program that they have
5 rectified in regards to their current program, and
6 their current program hasn't received any yet.

7 Now is that your understanding?

8 MR. ROWLEY: I understand that during the
9 power uprate proceedings was the last time NRC has
10 looked at it - looked at it for licensing only.

11 JUDGE WARDELL: Mr. Fitzpatrick, would you
12 like to elaborate?

13 MR. FITZPATRICK: As part of the license
14 renewal audits, Region One came in. They looked at
15 the program definitions, and reviewed the application.
16 Region One came in in either spring - it was either
17 January, February, March time, of 2007, looked at
18 programs for implementation. They looked at our
19 program procedures, and see if we were doing what we
20 committed to do.

21 JUDGE WARDELL: Thank you

22 JUDGE KARLIN: They came in and did a
23 review of your procedures and see if you were doing
24 what you were supposed to do?

25 MR. FITZPATRICK: Show me an example of

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1 this, show me an example -

2 JUDGE KARLIN: What did they find?

3 MR. FITZPATRICK: No significant findings,
4 I believe. They determined that reasonable assurance
5 that the program is being carried out as designed or
6 written.

7 JUDGE KARLIN: Is that document in the
8 record here, do you know?

9 DR. HOROWITZ: That was a regional
10 inspection report issued in June that documents that.
11 That is not referenced in our license renewal
12 application, but it was done. It is part of one of
13 the things that has to be done in order for an
14 applicant to go through an license renewal process,
15 separate from our safety evaluation report. But the
16 inspection report, the regional team comes in and does
17 their on-site inspection. They write a separate
18 report and gets to that issue, which was done in June
19 of -

20 JUDGE KARLIN: June of 2008?

21 DR. HOROWITZ: 2007.

22 JUDGE KARLIN: Okay. And do you agree
23 with Mr. Fitzpatrick?

24 DR. HOROWITZ: My reading of that report,
25 it does state no significant issues.

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1 JUDGE KARLIN: No significant issues? All
2 right.

3 JUDGE WARDELL: Dr. Horowitz, in 2005 the
4 Maihama Nuclear Plant - did I pronounce that right,
5 Japan?

6 DR. HOROWITZ: I think it was 2004 when
7 Maihama was burned.

8 JUDGE WARDELL: Okay, and it had a pipe
9 rupture; is that correct?

10 DR. HOROWITZ: Yes, sir.

11 JUDGE WARDELL: And it was in a downstream
12 of a small pipe wall orifice; is that correct? Was
13 that an FAC phenomena, or was it some other phenomena?

14 DR. HOROWITZ: FAC clearly.

15 JUDGE WARDELL: In your professional
16 opinion do you believe, or have you done any fact-
17 fitting analysis of that that would demonstrate that
18 CHECWORKS would have predicted this thing?

19 DR. HOROWITZ: I did not. We never found
20 out from the utility what the water chemistry
21 conditions were. EDF did an analysis with their code,
22 and they predicted - would have predicted the failure.

23 The fact of the matter is, is that any
24 experienced FAC engineer would have inspected that
25 location because it was an obvious location for

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1 failure downstream of the main flow measuring.

2 JUDGE WARDELL: Do you have any idea what
3 besides the fact that they should have caught it with
4 an inspection, did they have any other program that
5 they were using to assist them in highlighting
6 locations that might be critical in their inspection
7 programs?

8 DR. HOROWITZ: No, sir, they had no
9 analytical program, and that's true for the state.
10 Their philosophy had been to inspect, and divulge
11 instructions.

12 JUDGE WARDELL: Thank you. That's all I
13 have.

14 JUDGE KARLIN: Okay, I think we have asked
15 all our questions, with regard to contention #4.

16 So we are ready I think to conclude the
17 proceeding. And happily we may be able to finish with
18 some - with five minutes to spare.

19 No, we are not finished yet unfortunately.
20 But we are finished with the witness panel.

21 So I want to thank you all for your time
22 and effort. I know that many of you come from some
23 distance to be here. A lot of time and expense
24 involved in all of the witnesses being here and being
25 prepared.

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1 So thank you, gentlemen, for your
2 testimony and your patience with our questioning.

3 I think what we need to do before we close
4 is, I have at least four things that I want to talk
5 about, and I also want to elicit from the counsel if
6 there is anything else they think we should cover.

7 First I want to talk about transcript
8 corrections, the mechanics of that, make sure we get
9 the dates and the mechanics down.

10 Second, closing the record, we'll have to
11 do that.

12 Third, we are thinking about, we want to
13 reserve a date for an oral argument with regard to the
14 two issues that were briefed in July by the parties.
15 We may or may not need that oral argument. Quite
16 frankly we have not finished reviewing those briefs.
17 We spent a lot of time reading the materials, and we
18 want to continue to do that.

19 But we want to reserve a date as a hold
20 date for an oral argument sometime relatively soon.

21 And fourth, we want to talk about - a
22 little bit about the proposed findings of fact and
23 conclusions of law that are going to be due in 30
24 days, per the initial scheduling order we issued a
25 long time ago.

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1 Is there anything else that any of the
2 parties have at this time?

3 MR. HOFMANN: We have a hearing time
4 reserved in September, and I assume we can take the
5 lock off our schedules on that?

6 JUDGE KARLIN: Definitely, yes. We can
7 dispense with that. Good point.

8 MS. TAYLOR: Judge Karlin, do you know when
9 the transcripts will be available in Adams? NEC is
10 not buying them.

11 JUDGE KARLIN: Well, it's usually a week to
12 10 days. I do not know.

13 MS. TAYLOR: I think if that is the case,
14 I'm wondering if we could extend the deadline for the
15 conclusions of fact and laws to account for the fact
16 that we won't have them for a couple of weeks it
17 sounds like.

18 JUDGE KARLIN: Well, the regulations
19 prescribe a 30-day period with the court and the board
20 having an opportunity to change that. Yes, so we
21 would have the opportunity to change it. If we were
22 going to change it, I'd almost want to accelerate it.
23 I don't think we want to change it.

24 We need to get this matter resolved, and
25 I think the transcripts will be available in seven to

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1 10 days.

2 So are there any other matters other than
3 the four I just mentioned?

4 Okay. With regard to transcripts
5 corrections, first subject, transcript corrections,
6 please focus on material type changes and problems.
7 Don't give us a lot of minutiae. We don't need huge
8 long lists of errata.

9 And when you do submit your proposed
10 transcript corrections, we want you to have listened
11 to the tape beforehand, and you need to certify in
12 your transcript correction that you have listened to
13 the tape, and that the corrections you are proposing
14 are based upon what you heard and how it's corrected;
15 not what you think it should have been or might have
16 been or whatever.

17 Now the exceptions for that might be where
18 it's an acronym, or it's a word that is misspelled, or
19 a technical term that the court reporter may not have
20 captured. But if it's anything else, a yes to a no,
21 a did to a didn't, someone better listen. You need to
22 certify that you listened to the tape that the court
23 reporter has, and that's what you counsel, verify you
24 believe is the correct word there.

25 Because we have had situations before in

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1 the Vermont Yankee uprate, in fact, where there was a
2 dispute as to the wording. And you know what happens
3 then? We have to listen to the tape. And if there is
4 a dispute, we will have to listen to the tape. So we
5 want you to listen to the tape first, and that will
6 eliminate some disputes.

7 MS.UTTAL: Your Honor, how do we get the
8 tape?

9 JUDGE KARLIN: Well, you contact the court
10 reporter and you get a tape from him.

11 MS.UTTAL: Okay, will do.

12 JUDGE KARLIN: And then before you submit
13 your proposed transcript corrections, you also per the
14 normal motion practice you need to confer with the
15 other parties and see if they agree.

16 And so I think what we'd like to suggest,
17 and what we are going to say, is that all that needs
18 to be done, and the deadline for submitting proposed
19 transcript corrections is August 8, Friday, August 8,
20 16 days I think or so, 15 days from today.

21 So you are going to have to get this stuff
22 pretty fast from the court reporter.

23 DR. HAUSLER: Your Honor?

24 JUDGE KARLIN: Yes. Well, no wait a
25 second, you are not here to speak, sir. We are talking

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1 about the parties at this point.

2 I would ask Entergy to take the lead in
3 this matter, and to come up with a list that they
4 share with the other parties in terms of transcript
5 corrections.

6 And others of you, obviously anyone else
7 can take a laboring oar as well. But I think if
8 Entergy would take the lead, on the 16th - on August
9 8th please submit your - confer with your other
10 parties and on August 13 submit your proposed
11 transcript corrections to us.

12 So by the 8th you need to exchange them
13 among yourselves; by the 13th submit them to us; five
14 days later, on the 18th, you have - anyone who doesn't
15 like those corrections, if there are still some
16 residual problems with those corrections, they have
17 until the 18th of August to submit this - to submit
18 their objections.

19 With regard to closing the record, the
20 record will be closed - well, it's essentially closed
21 now. We are obviously not going to take any more
22 testimony; any more written exhibits.

23 But on the 13th of August is when the
24 errata or corrections come in, and at that point the
25 only thing that will change with regard to the record

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1 or any - we will accept any changes due to the
2 erratas, and we have an issue with regard to the
3 Commonwealth of Massachusetts, who have this appeal in
4 the 1st Circuit, and there is an order out there that
5 we can't close the records entirely.

6 But we are closing the record with regard
7 to everything of these contentions. And there is this
8 technical hold that is there because of the 1st
9 Circuit's decision for their issue.

10 Yes.

11 MR. LEWIS: Judge Karlin?

12 JUDGE KARLIN: Yes.

13 MR. LEWIS: For clarification purposes, in
14 the Pilgrim proceeding, that did not prevent the
15 closure of the record. The mandate in that case has
16 since issued, and therefore the 1st Circuit's
17 administrative stay has also lapsed.

18 JUDGE KARLIN: Okay. Well, that's helpful;
19 I will review that. Let me review that.

20 I did read the decision with regard to
21 Pilgrim case. I'm not sure, I'll have to read it
22 again, I'm not sure where that goes. We will hold
23 that in abeyance. I just don't want to foreclose Ms.
24 Curran and the State of Massachusetts from whatever
25 thing they may have.

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1 If their time is expired, I will probably
2 - we are going to dispense - everything that has been
3 litigated here is shut down and closed. If there is
4 some footnote that is going on with Massachusetts, or
5 something that happens in the 1st Circuit, obviously
6 we are not going to try to foreclose that.

7 I just wanted to recognize that as a
8 footnote to the closing of the record, and I will look
9 at that.

10 MR. RAUBVOGEL: Judge Karlin?

11 JUDGE KARLIN: Yes, sir.

12 MR. RAUBVOGEL: I'm sorry to go backwards,
13 but just to go for a second on the question of the
14 transcript, as I understand what you just said, the
15 corrections on the transcript I think you said are due
16 within 16 days.

17 JUDGE KARLIN: August 8th. No, no, they
18 are due to - what you do is submit them to each other;
19 exchange them; and then on the 13th of August you can
20 submit them to us.

21 MR. RAUBVOGEL: My point was going to be
22 that as my co-counsel mentioned, our client doesn't
23 have the resources to buy the transcript so we have to
24 wait until they are posted.

25 So I would ask if you can do two things.

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1 One is if you can find out whether an expedited
2 transcript can be ordered from the stenographer so
3 that it gets in the hands of the staff as soon as
4 possible; and then to ask that the staff post it
5 immediately so that there is no question that we are
6 going to get it as soon as we can.

7 Otherwise it's possible that NEC may not
8 have an opportunity, really, a meaningful opportunity
9 to review that transcript.

10 MS. BATY: Just for the record, we don't -
11 we staff don't post it. It's the FOB that is
12 responsible for doing it exactly with the additive.

13 JUDGE KARLIN: Well, I'm not even sure
14 whether he has LDP posted quite frankly. We turned
15 SECY, the people over at the Secretary's office post
16 it.

17 I noted on my email last night I already
18 had the transcript for Monday, but that's because
19 that's the contract, a three-day turn-around.

20 And I will instruct Mr. Emile Julian, or
21 whoever else there is, that we get this thing posted
22 as soon as humanly possible, expedited, and we will
23 try to give a report to everybody on that.

24 And if I find that it is going to be
25 significantly delayed or a problem, well, we will try

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1 to deal with that.

2 But we will try to get it as expedited as
3 humanly possible.

4 MR. RAUBVOGEL: Thank you.

5 JUDGE KARLIN: Oral argument: I guess we
6 can go to that. We think maybe a two-hour oral
7 argument, if we are going to have one, it's not going
8 to be long. It would involve the four parties who
9 have briefed this issue, or the three parties and the
10 State of Vermont if they wish.

11 I think they - I would say three - two to
12 three hours at most. I would like - and we are
13 proposing to have that on the morning of August 7th.

14 Would counsel look at - now I would note
15 that every party here has got multiple counsel, so
16 there has got to be somebody who is going to be
17 available on August 7th or one of these days at 9:00
18 a.m.

19 We would probably have it in Rockville, in
20 our hearing room in Rockville. Anyone who wanted to
21 could participate by telephonic connection, so you
22 could save money or avoid travel.

23 August 7th at 9:00 a.m. Mr. Lewis, are
24 you available?

25 MR. LEWIS: August 7th, yes.

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1 JUDGE KARLIN: NRC staff?

2 MS. BATY: Yes. I have jury duty, but
3 someone - one of us will be available.

4 JUDGE KARLIN: Okay, and Ms. Tyler?

5 MS. TYLER: Yes, I'm available.

6 JUDGE KARLIN: Great. Ms. Hoffman, Mr.
7 Roisman.

8 MS. HOFMAN: Mr. Roisman is available.

9 JUDGE KARLIN: Great. All right, then we
10 will schedule - well, we will tentatively schedule
11 oral argument for Thursday, August 7th, at 9:00 a.m.
12 We will let you know whether we are really going to
13 proceed with that.

14 I mean if we get done reading and we don't
15 have - don't think we need it, we won't - we will
16 cancel it, okay? But it's a go unless we cancel;
17 that's probably they way to put that.

18 MR. ROTH: Judge Karlin?

19 JUDGE KARLIN: Yes.

20 MR. ROTH: We briefed that matter at hand
21 in federal argument, and I don't intend to ask for the
22 right to appear and argue. But I would like to be
23 able to listen in telephonically. Would that be
24 possible?

25 JUDGE KARLIN: Yes, I think you can

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1 participate by phone, listen in telephonically.

2 MR. ROTH: Thank you.

3 JUDGE KARLIN: And Ms. Curran from the
4 State of Massachusetts can sit in too if she wants,
5 but she is not here.

6 JUDGE WARDELL: Mr. Lewis, do you plan on
7 being there in person?

8 MR. LEWIS: It would be my plan, yes.

9 JUDGE WARDELL: So the staff will be here
10 in person?

11 JUDGE KARLIN: Okay. All right, I think -
12 is that it? I think that covers it.

13 Before we close I would just like to
14 thank, express some appreciation first to the parties.
15 They spent an enormous amount of time and effort
16 preparing, marshaling evidence and presenting it in
17 the prehearing filings while the piles of which - this
18 is just one pile for one contention, and we have three
19 piles and more. So obviously, a tremendous amount of
20 work.

21 The witnesses, long hot days, patient
22 explanations and answers to our not always
23 sophisticated questions, certainly from me anyway, I
24 would take that.

25 I would also thank, in addition to the

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1 witnesses and the parties, the lawyers who usually
2 play a large role in a hearing, in a trial; in this
3 case they had to bite their tongues and all sit
4 quietly, and they did a tremendous job in being calm
5 and collected through this long process. I don't know
6 how you did it.

7 JUDGE WARDELL: And hardly dozed.

8 JUDGE KARLIN: Yeah. We would also thank
9 the courtroom here, Mr. Robinson, and the sheriff of
10 the county, and the judges who have this courtroom in
11 making it available. It was warm, but it's a
12 beautiful courtroom, and we like it.

13 I want to express thanks to Karen Valloch
14 of our staff, and our two law clerks, Marcia
15 Carpentier and Lauren Bregman.

16 Finally, I would also express thanks to
17 the concerned citizens of Vermont. I don't know the
18 people who came in here on the first day, and there
19 were a tremendous number of people, standing room
20 only; a number of dedicated and hearty souls who
21 stayed through the entire proceeding, and who have
22 kept a vigil, and kept an eye on us through the whole
23 thing. And we know that, and we appreciate that. I
24 don't know whether they are pro, I don't know whether
25 they are con. But we take seriously our

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1 responsibility, and I appreciate them being here, and
2 observing, because this is a public process, and we
3 appreciate that we are able to conduct this in a
4 peaceable way and to get through a lot of material, so
5 that was good.

6 Where do we go from here? We are not
7 going to decide this case today obviously. In 30 days
8 there will be proposed findings of fact and
9 conclusions of law.

10 Ah, I want to just speak to that if I
11 could. I forgot to really talk about that.

12 When you do your proposed findings of fact
13 and conclusions of law, please, this is to help us try
14 to help us develop a decision and write our decision.
15 And if you want us to rule in your favor, then you
16 probably want to write it in a way that helps us, and
17 I think all the lawyers know that.

18 Cite the transcript pages, if you say
19 somebody made a statement, and cite the names of the
20 witnesses who made the statement. Don't just say, the
21 staff testified X. There are a lot of staff people
22 who have been involved here, and maybe one witness -
23 we want to know the names of the witnesses who
24 testified; we want to know the exhibits, and cite them
25 and cite the pages of the exhibits because some of

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1 these are hundreds of pages long, and we want to know
2 specifically what page, because we - because that's
3 how we are going to try to cite it when we - if we are
4 writing it, and that's how we are going to cite the
5 transcript.

6 And when you cite the law, one thing that
7 is sort of a nuance that you might not be familiar
8 with, when you cite the NRC case law, like 60 NRC at
9 235, cite the LBP number or the CLI not number but
10 letters, because that makes a big difference. LBP
11 means it's a licensing board; and CLI means it's a
12 commission decision. And commission decisions, if
13 they are relevant and on point and it's a holding,
14 they are binding on us. And if it's a board decision,
15 like some other board, where just like another trial
16 court, and they are helpful, could be helpful, but
17 they are not binding. So it would be very helpful if
18 you could have that.

19 So 30 days from now we will get the
20 proposed finding of fact, conclusions of law, and
21 under the regs, basically, we shoot to get the
22 decision out 90 days after that. So 120 days from
23 today, and we are going to try to make that. There is
24 a lot of material; there are three big contentions.

25 But that's where we go from here. Thank

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1 you for your attention and patience, and we are now
2 adjourned.

3 (Whereupon at 5:09 p.m. the proceeding in
4 the above-entitled matter was adjourned)

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CERTIFICATE

This is to certify that the attached proceedings
before the United States Nuclear Regulatory Commission
in the matter of:

Entergy Nuclear Vermont

Yankee, LLC & Entergy

Nuclear Operations, Inc.

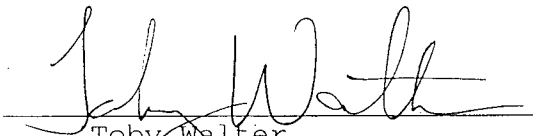
Name of Proceeding: Hearing

Docket Number: 50-271-LR,

ASLBP No. 06-849-03-LR

Location: Newfane, Vermont

were held as herein appears, and that this is the
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